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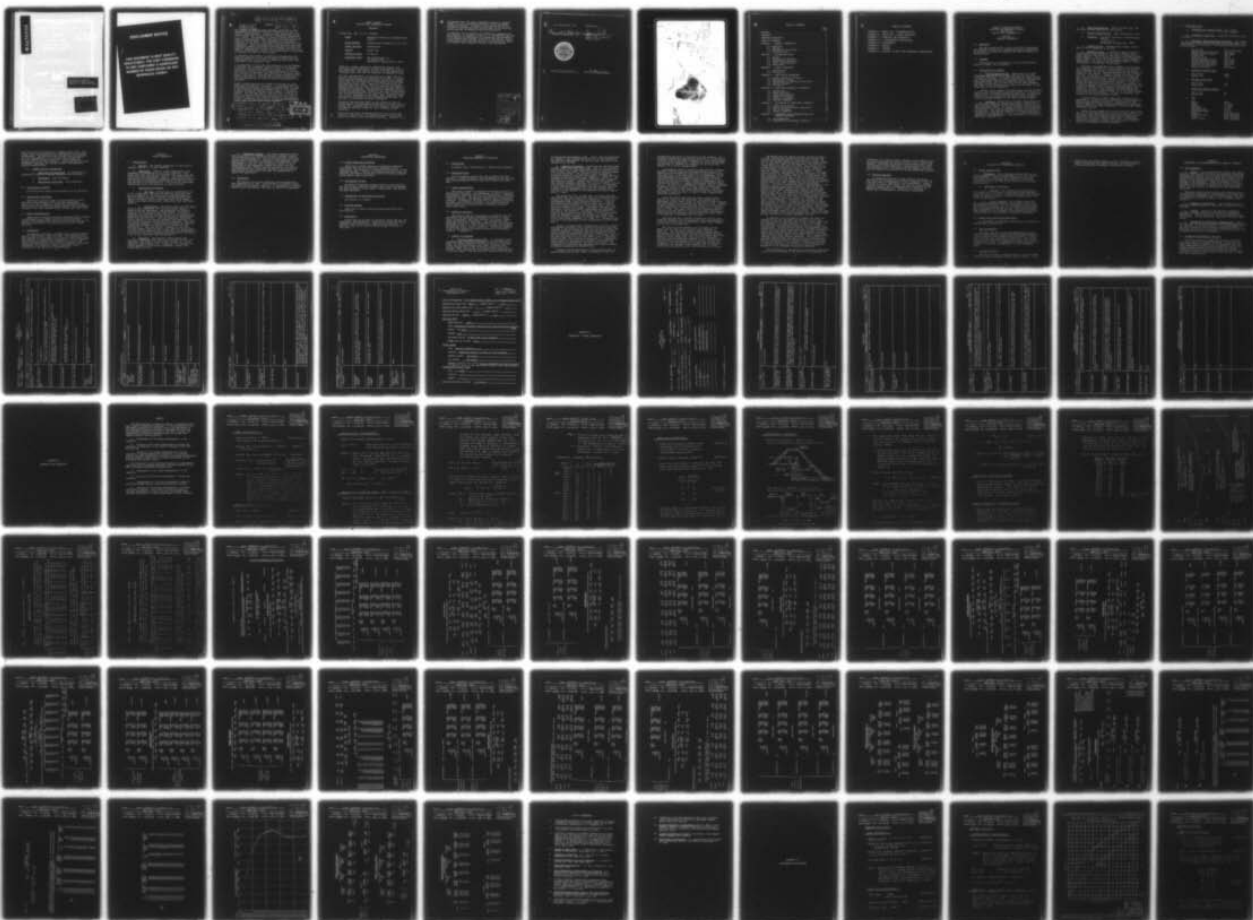
NATIONAL DAM INSPECTION PROGRAM. BEAVER DAM (NDI I.D. NUMBER PA--ETC(U)

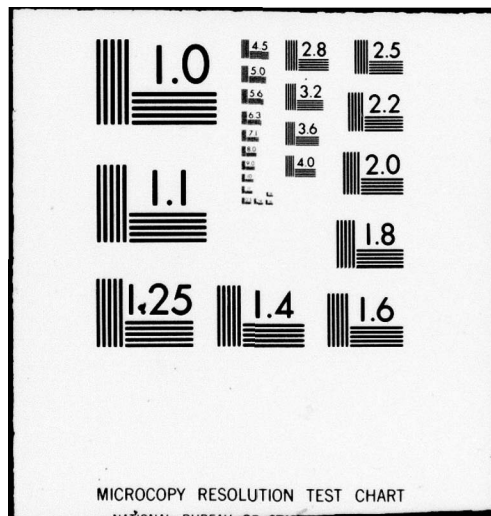
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PREFACE

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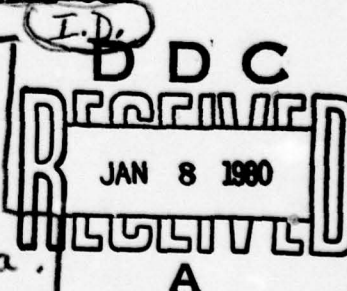
This report is prepared under guidance contained in the Recommended Guidelines for Safety Inspection of Dams, for Phase I investigations. Copies of these guidelines may be obtained from the Office of Chief of Engineers, Washington, D. C. 20314. The purpose of a Phase I investigation is to identify expeditiously those dams which may pose hazards to human life or property. The assessment of the general condition of the dam is based upon available data and visual inspections. Detailed investigation and analyses involving topographic mapping, subsurface investigations, testing, and detailed computational evaluations are beyond the scope of a Phase I investigation; however, the investigation is intended to identify any need for such studies.

In reviewing this report, it should be realized that the reported condition of the dam is based on observations of field conditions at the time of inspection along with data available to the inspection team.

It is important to note that the condition of a dam depends on numerous and constantly changing internal and external conditions, and is evolutionary in nature. It would be incorrect to assume that the present condition of the dam will continue to represent the condition of the dam at some point in the future. Only through frequent inspections can unsafe conditions be detected and only through continued care and maintenance can these conditions be prevented or corrected.

Phase I inspections are not intended to provide detailed hydrologic and hydraulic analyses. In accordance with the established guidelines, the spillway design flood is based on the estimated "Probable Maximum Flood" for the region (greatest reasonably possible storm runoff), or fractions thereof. The spillway design flood provides a measure of relative spillway capacity and serves as an aid in determining the need for more detailed hydrologic and hydraulic studies, considering the size of the dam, its general condition, and the downstream damage potential.

(6) National Dam Inspection Program.  
Beaver Dam (NDI I.D. Number  
PA-00453, Penrider Number 65-7),  
Ohio River Basin, Beaver Run,  
Westmoreland County, Pennsylvania.  
Phase I Inspection Report.



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PHASE I REPORT  
NATIONAL DAM INSPECTION PROGRAM

ABSTRACT

Beaver Dam: NDI I.D. No. PA-00453

<u>Owner:</u>	Municipal Authority of Westmoreland County
<u>State Located:</u>	Pennsylvania (PennDER I.D. No. 65-7)
<u>County Located:</u>	Westmoreland
<u>Stream:</u>	Beaver Run
<u>Inspection Date:</u>	25 May 79
<u>Inspection Team:</u>	GAI Consultants, Inc. 570 Beatty Road Monroeville, Pennsylvania 15146

[cont'd from p. 1]

Based on a visual inspection, operational history, and available engineering data, the dam is considered to be in poor condition. The defunct facility has been essentially abandoned since 1952 and its reservoir is sediment filled.

The size classification of the facility is small and its hazard classification is considered to be high. In accordance with the recommended guidelines, the spillway design flood (SDF) for the facility is considered to be the Probable Maximum Flood (PMF). Results of the hydrologic and hydraulic analysis indicate that the facility is capable of passing and/or storing only 36 percent of the PMF without embankment overtopping. Overtopping and embankment failure is also anticipated under floods of less than 1/2 PMF magnitude which would result in an increase in the potential for loss of life downstream of the dam. Thus, based on screening criteria contained in the recommended guidelines, the spillway is considered seriously inadequate.

Structural deficiencies noted by the inspection team included substantial embankment overgrowth, an access road cut through the embankment near the left abutment, cracking of the masonry spillway wingwalls, and a sediment filled reservoir.

Due to the seriously inadequate spillway and overall poor condition, the facility is considered unsafe but non-emergency as failure is not considered imminent. However, it is

recommended that the owner immediately develop a warning system to notify downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, as the facility is essentially abandoned and the reservoir is sediment filled, it is recommended that the owner assess the feasibility of dismantling the embankment in accordance with PennDER, Division of Dam Safety, regulations and/or modifying the facility to eliminate the potential hazard due to possible failure from overtopping.

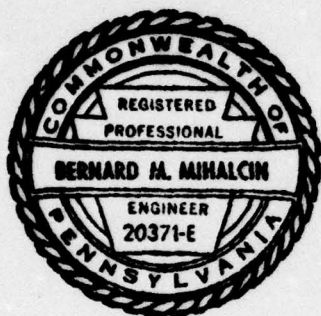
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GAI Consultants, Inc.

Approved by:

Bernard M. Mihalcin  
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James W. Peck  
JAMES W. PECK  
Colonel, Corps of Engineers  
District Engineer



Date 19 July 1979

Date 13 August 1979



OVERVIEW PHOTOGRAPH

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PHASE I INSPECTION REPORT  
NATIONAL DAM INSPECTION PROGRAM  
BEAVER DAM  
NDI# PA-453, PENNDER# 65-7

SECTION 1  
GENERAL INFORMATION

1.0 Authority.

The Dam Inspection Act, Public Law 92-367, authorized the Secretary of the Army, through the Corps of Engineers, to initiate a program of inspection of dams throughout the United States.

1.1 Purpose.

The purpose is to determine if the dam constitutes a hazard to human life or property.

1.2 Description of Project.

a. Dam and Appurtenances. Beaver Dam is an earth embankment approximately 32 feet high and 385 feet long (including spillway). The defunct facility no longer serves its original purpose as a water supply facility and has been idle since 1952. The dam is constructed with a masonry spillway located about 35 feet left of the right abutment. The crest of the spillway is 100 feet long and about 11 feet below the top of its wingwalls. - - - - - [cont'd on p. 11]

Several outlet conduits are associated with the facility; however, only one presently retains a degree of operability. That conduit, a 48-inch diameter blowoff pipe, is reportedly located in a rock tunnel cut through the right abutment which discharges adjacent to the right spillway wingwall.

b. Location. Beaver Dam is located across Beaver Run in Washington Township, Westmoreland County, Pennsylvania, about 1/2-mile upstream of the confluence of Beaver Run and the Kiskiminetas River. The towns of Apollo and Vandergrift, Pennsylvania, are situated downstream about 2 miles north of the facility. The dam and reservoir are located within the Vandergrift, Pennsylvania, U.S.G.S. 7.5 minute topographic quadrangle (see Appendix G). The coordinates of the dam are N40° 34.9' and W79° 34.3'.

c. Size Classification. Small (32 feet high, 148 acre-feet storage capacity at top of dam).

d. Hazard Classification. High (see Section 3.1.e).

e. Ownership. Municipal Authority of Westmoreland County  
P. O. Box 730  
Greensburg, Pennsylvania 15601

f. Purpose of Dam. Formerly water supply; has not been in active operation since 1952.

g. Historical Data. A historical report available from PennDER files (dated May 18, 1915) indicates that Beaver Dam was constructed in 1901-1902 by the Apollo Water Works Company, a wholly owned subsidiary of the Pennsylvania Water Company, to serve the water supply needs of nearby communities. The facility was designed by James H. Harlow and Company of Pittsburgh, Pennsylvania.

Available correspondence from PennDER files indicates that reservoir siltation was a major problem at this facility throughout its history. Modifications to the outlet works were made on two separate occasions for the purpose of aiding in silt removal. Sometime between the years of 1902 and 1915, a hole was cut through the face of the spillway and a 24-inch diameter cast iron pipe (C.I.P.) installed. This conduit was to provide a means of blowing out the silt behind the dam, but its success was limited. In 1919, a tunnel was excavated through rock in the right abutment and a 48-inch diameter blowoff line installed, primarily for the purpose of desilting the reservoir. Correspondence indicates that in 1924, it was proposed that the sediment be removed by hydraulic means; however, it is not known whether or not the plan was executed. In 1941, the reservoir was reported to be totally sediment filled.

A state inspection report dated 1935 indicated that ownership of the facility was transferred to the Vandergrift Water Company sometime after 1932. Maintenance of the facility appears to have steadily declined with maintenance-related deficiencies being addressed in 1948 and 1964 state inspection reports.

Beaver Dam was phased out of active service upon completion of the upstream Beaver Run Dam in the early 1950's. At this time, both facilities were owned and operated by the Municipal Authority of Westmoreland County. Downstream facilities, including filters, pump house, and caretaker's house were subsequently removed and the facility, for all intents and purposes, has been abandoned.

### 1.3 Pertinent Data.

a. Drainage Area (square miles). 10.9 (local)  
54.4 (total)

b. Discharge at Dam Site. Discharge records are not available.

c. Elevation (feet above mean sea level). The following elevations were obtained through field measurements that were based on the elevation of the emergency spillway crest at 843.5 feet.

Top of Dam	850.8 (low spot)
Maximum Design High Water	Not known
Maximum Pool of Record	Not known
Normal Pool	843.5
Spillway Crest	843.5
Outlet Upstream Invert	Not known
Outlet Downstream Invert	Not known
Streambed at Dam Center	Not known
Base of Stilling Basin	818.8
Maximum Tailwater	Not known

d. Reservoir Length (feet).

Top of Dam	5000
Normal Pool	4000

e. Storage (acre-feet).

Top of Dam	148
Normal Pool	18

f. Reservoir Surface (acres).

Top of Dam	24
Normal Pool	12

g. Dam.

Type	Earth
Length	385 feet
Height	32 feet
Top Width	10 feet
Upstream Slope	2H:1V
Downstream Slope	1.5H:1V
Zoning	None indicated
Impervious Core	None indicated
Cutoff	None indicated
Grout Curtain	None indicated

h. Overview and Regulating  
Tunnels.

None

i. Spillway.

Type

Concrete overflow  
section with masonry  
wingwalls.

Crest Elevation

843.5

Crest Length

100.0 feet

j. Outlet Conduits.

Type

48-inch diameter  
C.I.P. placed in a  
tunnel cut through  
rock in the right  
abutment.

Length

Not known

Closure

Valve with manual  
control mechanism  
located in circular,  
vertical chamber at  
right abutment.

Access

Access to right  
abutment area is  
difficult. Condi-  
tion of valve  
chamber renders  
valve control  
practically inoper-  
able; however, valve  
is apparently in  
open position.

## SECTION 2 ENGINEERING DATA

### 2.1 Design.

#### a. Design Data Availability and Sources.

1. Hydrology and Hydraulics. No design data, calculations, or reports are available.

2. Embankment. No design data, calculations, or reports are available. Limited data pertaining to the design features of Beaver Dam are contained within PennDER files in the form of state inspection reports, dated photographs, and miscellaneous correspondence. No design or construction drawings are available. A brief stability analysis (dated 1915) of the spillway structure, presumably by PennDER personnel, is also available.

3. Appurtenant Structures. See 2 above.

#### b. Design Features.

1. Embankment. Based on information contained in PennDER files, general statements can be made regarding the embankment design. The facility was constructed in 1901-1902 and consists of three sections, a masonry and concrete spillway flanked by earth embankments. The right embankment is about 35 feet long while the left embankment measures about 250 feet in length. No information is available pertaining to the internal design of the earth section or the foundation. The embankment was constructed with a 2H:1V upstream slope, a 1.5H:1V downstream slope, and a 10-foot top width. The original embankment upstream slope was covered with stone to the flow line while the remainder of the embankment was grass covered.

2. Spillway. The spillway overflow is constructed of rubble masonry covered with a facing of concrete. It is 100 feet long and flanked by rubble masonry wingwalls. The structure is reportedly placed on a shale foundation and is constructed with a corewall that is carried 30 feet into both embankment sections.

3. Outlet Works. The facility was originally constructed with a 24-inch diameter C.I.P. passing under the main embankment and reportedly founded in natural soil. The conduit was separated into three lines downstream of the embankment with a 24-inch diameter by 16-inch diameter cross. One line continued to the filter plant, one reduced to a 12-inch diameter blowoff that discharged into the stream channel,

while the third line served as a reserve supply line. The outlet works were modified twice subsequent to the original construction. The modifications included the installation of a 24-inch diameter C.I.P. through the spillway and a 48-inch diameter conduit placed in a tunnel excavated through rock in the right abutment. Both modifications were presumably undertaken to provide a means of discharging sediment accumulations.

b. Design Data and Procedures.

1. Hydrology and Hydraulics. No design data or information relative to design procedures are available.
2. Embankment. None available.
3. Appurtenant Structures. None available.

2.2 Construction Records.

No construction records are available for the facility.

2.3 Operational Procedures.

The facility has not been in active operation since 1952 and is now sediment filled and self-regulating. During the visual inspection, discharge was observed from the vicinity of the 48-inch diameter blowoff line reportedly located at the right abutment which remains open year round.

2.4 Other Investigations.

There are no available records concerning formal studies or investigations of Beaver Dam other than inspection reports from PennDER files dating to 1915 and a brief set of stability calculations for the spillway structure (dated May 1915).

2.5 Evaluation.

Information contained in PennDER files indicates Beaver Dam was constructed in 1901 and 1902. The earliest available records are contained in a historical report dated 1915, approximately 14 years after construction. Little engineering data and no drawings are available relative to the design and construction of the facility; however, sufficient information is available to make a reasonable Phase I evaluation of the dam and its appurtenances.

### SECTION 3 VISUAL INSPECTION

#### 3.1 Observations.

a. General. The general appearance of the facility suggests that it is in poor condition.

b. Embankment. Based on visual observations, the embankment is considered to be in poor condition. The slopes and crest are heavily overgrown with large trees and thick brush (see Photographs 1 and 4). The structure has been partially breached by a temporary construction road cut through the left embankment approximately 40 feet from the left abutment (see Photograph 4). The road has effectively reduced the top of dam elevation by about two feet.

c. Appurtenant Structures.

1. Spillway. The spillway is considered to be in fair condition. Cracking was observed along the wing-walls, primarily at the mortar joints (see Photograph 3). The area behind the weir is heavily sedimented while some debris, including several large logs, were found lodged against the crest and partially obstructing flow (see Photograph 1).

2. Outlet Works. The outlet works are considered to be in poor condition. The original outlet conduit, beneath the main embankment, was presumably disconnected after use of the facility was discontinued. A 24-inch diameter line extending through the face of the spillway is inoperable and has been for many years due to sedimentation behind the spillway weir. The only apparently functional outlet conduit is the 48-inch diameter pipe reportedly in a rock tunnel extending through the right abutment. This line is presumed operable as considerable discharge was observed through the abutment on the day of the inspection (see Photograph 7). The gate control, located in a circular, vertical chamber about 30 feet to the right of the spillway, is practically inaccessible and inoperable (see Photograph 5). A portion of the inlet structure was observed and also found to be in poor condition (see Photograph 6).

d. Reservoir. The reservoir behind Beaver Dam originally contained about 70 million gallons of water (215 acre-feet) and formed a 12-acre lake according to a state inspection report dated 1915. Presently, the reservoir is almost sediment filled and more resembles a marsh (see Photographs 9 and 10).

e. Downstream Channel. The stream immediately below Beaver Dam flows in a northerly direction through a partially developed valley with a broad base and steep confining slopes (see Photograph 8). The first residences are located approximately 1,500 feet downstream of the embankment (see Photographs 11 and 12). At a distance of about 1/2 mile downstream of the embankment, Beaver Run flows into the Kiskiminetas River. Within the next two miles, the banks of the Kiskiminetas are lined with residential and industrial developments as the river flows past the communities of Apollo and Vandergrift.

### 3.2 Evaluation.

The facility is in poor condition, having essentially been abandoned since 1952. The reservoir is sediment filled and offers little storage capacity. In accordance to recently enacted state legislation, the facility should be dismantled.

## SECTION 4 OPERATIONAL PROCEDURES

### 4.1 Normal Operating Procedure.

There are no formal operating procedures associated with Beaver Dam and the facility is essentially self-regulating. The reservoir is sediment filled and has little remaining storage. Inflows are discharged directly over the spillway and through the blowoff line at the right abutment which remains open continuously.

### 4.2 Maintenance of Dam.

No formal maintenance program exists at this facility. Its overall poor condition suggests that little maintenance has been performed in many years. Essentially, the facility has been abandoned.

### 4.3 Maintenance of Operating Facilities.

See Section 4.2 (above).

### 4.4 Warning Systems.

There are no formal warning systems associated with this facility.

### 4.5 Evaluation.

Beaver Dam has not been in operation since 1952 and has essentially been abandoned. There are no formal manuals or procedures for maintaining or operating the facility. In addition, there is no formal warning system in effect at this site.

## SECTION 5 HYDROLOGIC/HYDRAULIC EVALUATION

### 5.1 Design Data.

No design data, calculations, or reports are available.

### 5.2 Experience Data.

Actual discharge records are not available for this facility. No data related to the performance of the facility and its appurtenances during major flood events are available.

### 5.3 Visual Observations.

The visual inspection revealed the facility to be in a deteriorated condition. The embankment is heavily overgrown and partially breached near the left abutment by a temporary construction road. The spillway overflow section is in good condition; however, the masonry wingwalls show considerable cracking. In addition, the reservoir is sediment filled and has very little remaining storage. The above conditions raises doubts as to the facility's reliability during a major flood event.

### 5.4 Method of Analysis.

The facility has been analyzed in accordance with the procedures and guidelines established by the U. S. Army, Corps of Engineers, Baltimore District, for Phase I hydrologic and hydraulic evaluations. The analysis has been performed utilizing a modified version of the HEC-1 program developed by the U. S. Army, Corps of Engineers, Hydrologic Engineering Center, Davis, California. Analytical capabilities of the program are briefly outlined in the preface contained in Appendix C.

### 5.5 Summary of Analysis.

a. Spillway Design Flood (SDF). In accordance with procedures and guidelines contained in the National Guidelines for Safety Inspection of Dams for Phase I investigations, the Spillway Design Flood (SDF) for Beaver Dam ranges between the 1/2 PMF (Probable Maximum Flood) and the PMF. This classification is based on the relative size of the dam (small), and the potential hazard of dam failure

to downstream developments (high). Due to the high potential for damage to many residences as well as to the presence of two upstream impoundments, the SDF for this facility is considered to be the PMF.

b. Results of Analysis. Beaver Dam was analyzed under assumed normal operating conditions. That is, the reservoir was initially at its estimated normal pool or spillway elevation of 843.5 feet (MSL), with the low-level outlets assumed to be non-functional. The reservoir area is presently virtually silted in such that only about a 1.5-foot depth of storage exists below normal pool (Appendix C, Sheet 2). The spillway is, by design, a masonry, ogee-like weir structure with concrete facing. However, due to the silt problem, the spillway presently performs like a free overfall, critical flow control structure (Appendix C, Sheet 7). In addition, a small construction area access road was recently cut into a portion of the embankment near the left abutment which resulted in the lowering of the effective low top of dam by about 1.7 feet.

The Beaver Run Dam, located about 5.5 miles upstream from Beaver Dam along Beaver Run, was also evaluated in this analysis to assess its effects on Beaver Dam. It too was investigated under normal operating conditions. That is, the Beaver Run Dam reservoir was initially at its normal pool or spillway elevation of 1050.0 feet (MSL), with its low-level blowoff line closed. Information concerning the reservoir's elevation-storage relationship was available and used in the analysis. The Beaver Run Dam facility is serviced by a concrete shaft spillway. The 215 feet (estimated) of embankment at the left abutment is sloped such that the vertical alignment of the dam drops about 5 feet within this length (Appendix C-1, Sheet 17). Therefore, the low top of dam elevation is that corresponding to the 5-foot drop.

Finally, Gilkerson Dam, located about 0.5 mile upstream from Beaver Dam along a small tributary to Beaver Run, was included in the evaluation so that its effects on Beaver Dam could be assessed. Gilkerson Dam was also analyzed under normal operating conditions, which were assumed to be that the facility's reservoir was initially at its normal pool or spillway elevation of 1,023 feet (MSL), with its low-level outlet closed. The Gilkerson Dam spillway is a combination riprap paved and concrete chute channel, with discharges controlled by a rectangular, critical flow section. All Gilkerson Dam elevations and dimensions are based on design information contained in PennDER files.

Necessary downstream channel routing between dams and beyond Beaver Dam was done under the assumption that the

streams were dry prior to the inflow of dam outflows. All pertinent engineering calculations relative to the evaluation of Beaver Dam are provided in Appendix C, while calculations relative to the evaluations of Beaver Run and Gilkerson Dams are provided in Appendix C-1 (Sheets 1 to 20 of 20, and Sheets 1 to 11 of 11, respectively).

Overtopping analysis (using the Modified HEC-1 Computer Program) indicated that the discharge/storage capacity of Beaver Dam can accommodate only about 36 percent of the PMF (the SDF) prior to the overtopping of its embankment, while the discharge/storage capacities of both Beaver Run and Gilkerson Dams can accommodate floods in excess of 50 percent of the PMF prior to their respective embankments being overtopped (Appendix C, Summary Input/Output Sheets, Sheets U and V). The low top of embankment of Beaver Dam was inundated by depths of water of about 1.8 feet under 1/2 PMF conditions, and about 4.5 feet under PMF conditions. The low tops of dam of Beaver Run and Gilkerson Dams were inundated by depths of water of about 4.0 and 0.3 feet, respectively, under PMF conditions.

Since the Beaver Dam facility cannot safely handle a flood of at least 1/2 PMF magnitude, the possibility of embankment failure under floods of less than 1/2 PMF intensity was investigated (in accordance with ETL-1110-2-234). Several feasible alternatives were analyzed, since it is difficult, if not impossible, to determine exactly how or if a specific dam will fail. The major concern of the breaching evaluations is with the impact of the various breach discharges on increasing downstream water surface elevations above those to be expected if breaching did not occur.

The Modified HEC-1 Computer Program was used for the breaching analysis with the assumption that the breaching of a dam would begin once its reservoir's water level reached the low top of dam elevation.

Two sets of breach geometry were analyzed for the Beaver Dam for each of two failure times (Appendix C, Sheet 11). The two sets of breach sections chosen were considered to be the minimum and maximum possible sections. The two failure times (total time for each breach section to reach its final dimensions) under which the two breach sections were evaluated were assumed to be a moderate time (1.0 hours) and a prolonged time (4.0 hours) so that the effects of this most sensitive variable might be examined. In addition, an average or more probable set of breach conditions was analyzed, with a failure time of 2.0 hours.

The Beaver Dam peak breach outflows (resulting from a 0.38 PMF overtopping) ranged from about 6480 cfs for the minimum section-prolonged fail time scheme, to about 7560 cfs for the maximum section-minimum fail time scheme (Appendix C, Sheet 13), based on the assumption that the silt volume behind the dam would not flow. The outflow for the average breach conditions was about 6470 cfs, compared to the non-breach 0.38 PMF peak facility outflow of about 6480 cfs (Summary Input/Output Sheets, Sheet V). The water surface elevation corresponding to the non-breach 0.38 PMF peak discharge at a section (Section 7) located about 1,200 feet downstream from the dam (at the first structure) was approximately 812.7 feet (MSL), that at a section (Section 8) located about 1,800 feet downstream from the dam was approximately 809.8 feet (MSL) (Summary Input/Output Sheets, Sheet V). The water surface elevations corresponding to the average condition peak breach outflow at the two above-mentioned downstream sections were about 813.0 feet (MSL) and 810.6 feet (MSL), respectively (Summary Input/Output Sheets, Sheet EE). The approximate elevations of the first three houses located at Section 7 are about 819 feet (MSL), 816 feet (MSL), and 811 feet (MSL); the approximate elevation of the two houses located at Section 8 is about 807 feet (MSL) (field measured). Therefore, the increase in the water surface at Section 7 caused by the failure of Beaver Dam was about 0.3 feet, with the breach water surface above the damage level of only one of the structures. The increase in the water surface at Section 8 caused by the failure of the dam was about 0.8 feet, with the breach water surface above the damage levels of both structures. (Note that those houses affected by the breach outflows would also be flooded by the 0.38 PMF even without embankment failure.)

In addition to the breaching of Beaver Dam under the assumption that the impounded silt would not move, the facility was failed assuming that the silt would indeed flow. This assumption is quite realistic, since it is highly unlikely that a significant portion of the silt volume has consolidated. The peak breach outflow (corresponding to the average breach conditions and under the 0.38 PMF overtopping event) was, then, about 7980 cfs, which resulted in downstream water surface elevations of approximately 813.6 feet (MSL) and 812.0 feet (MSL) at Sections 7 and 8, respectively (Summary Input/Output Sheets, Sheet EE). The increase in the water surface above the base elevations caused by this mode of failure was about 0.9 feet at Section 7, and about 2.2 feet at Section 8. In addition, a significant portion of the 200 or so acre-feet of silt will most probably be deposited on the immediate downstream floodplain.

The consequences of dam failure can be better envisioned if not only the increase in the height of the floodwave is

considered, but also the great increase in the momentum that the larger and probably swifter moving volume of water will possess. Therefore, the failure of Beaver Dam under floods of less than 1/2 PMF magnitude is quite possible, and will most probably lead to increased property damage (both water and silt damage) and loss of life in the downstream community.

#### 5.6 Spillway Adequacy.

As presented previously, under existing conditions Beaver Dam can accommodate only about 36 percent of the PMF (the SDF) prior to overtopping of its embankment. Should a 0.38 PMF or larger event occur, the dam will be overtopped and will possibly fail, endangering many residences in the immediate downstream area. Therefore, the spillway of Beaver Dam is considered to be seriously inadequate.

## SECTION 6 EVALUATION OF STRUCTURAL INTEGRITY

### 6.1 Visual Observations.

a. Embankment. The conditions observed during the field inspection suggest the embankment is in poor condition suffering from a long-term lack of maintenance and care. Such extensive and on-going deterioration is considered serious in light of the age of the facility and its hazard classification.

#### b. Appurtenant Structures.

1. Spillway. The condition of the spillway is considered fair. No signs of deterioration were observed along the overflow section. Significant cracks were observed along the masonry wingwalls and their integrity under large flows is questionable.

2. Outlet Conduits. The original outlet conduits associated with the facility have been disconnected and presumably plugged. The 24-inch diameter pipe through the face of the spillway has not functioned for many years, due to sedimentation behind the dam. The 48-inch diameter pipe through the right abutment was discharging during the field inspection and reportedly discharges continuously.

### 6.2 Design and Construction Techniques.

No information is available that details the methods of design and/or construction.

### 6.3 Past Performance.

No formal records of past performance are available from the owner; however, historical accounts and inspection reports available from PennDER recount a history of reservoir siltation that could not be controlled. The facility appears to have been well-maintained up until about 1932. A noticeable increase in maintenance related deficiencies is evident in available correspondence for the succeeding years.

### 6.4 Seismic Stability.

The dam is located in Seismic Zone No. 1 and is, thus, subject to minor earthquake induced dynamic forces. It is

thought that the static stability of the structure is sufficient to withstand such forces; however, no calculations or investigations were performed to confirm this opinion.

SECTION 7  
ASSESSMENT AND RECOMMENDATIONS FOR REMEDIAL MEASURES

7.1 Dam Assessment.

a. Safety. Visual observations indicate the overall facility to be in poor condition and essentially abandoned. Hydrologic and hydraulic calculations performed during this investigation indicate that the facility will pass only 36 percent of the Probable Maximum Flood (PMF) prior to overtopping of the embankment. Based on screening criteria provided by the Department of the Army, Office of Chief of Engineers, the spillway is deemed to be "seriously inadequate" and the facility is considered to be "unsafe-non-emergency".

Structural deficiencies noted by the inspection team included heavy overgrowth of the embankment, an access road cut through the embankment near the left abutment, cracking of the masonry spillway wingwalls, and a sediment filled reservoir.

b. Adequacy of Information. The available data is considered adequate based on the current disposition of the facility.

c. Urgency. Because of the seriously inadequate spillway, a formal warning system should be immediately implemented. Studies related to the final disposition of the facility, as discussed below, should be initiated immediately.

d. Necessity for Additional Investigations. Due to the fact that the facility has been essentially abandoned and its reservoir filled with sediment, it is recommended that the owner assess the feasibility of dismantling and/or modifying the facility to eliminate its potential hazard due to possible failure from overtopping.

7.2 Recommendations/Remedial Measures.

Due to the seriously inadequate spillway classification, the facility is considered unsafe. Failure is not considered imminent; however, it is recommended that the owner immediately develop a warning system to notify downstream residents should hazardous conditions develop. Included in the plan should be provisions for around-the-clock surveillance of the facility during periods of unusually heavy precipitation.

In addition, as the facility is essentially abandoned and the reservoir sediment filled, it is recommended that the owner assess the feasibility of dismantling the embankment in accordance with PennDER, Division of Dam Safety, regulations and/or modifying the facility to eliminate the potential hazard due to possible failure from overtopping.

APPENDIX A  
CHECK LIST - ENGINEERING DATA

CHECK LIST  
ENGINEERING DATA  
PHASE I

NAME OF DAM: Beaver Dam  
NDI#: PA-453 PENNDR#: 65-7

PAGE 1 OF 5

ITEM	REMARKS	NDI# PA - 453
PERSONS INTERVIEWED AND TITLE	Paul Baker (Security - Municipal Authority of Westmoreland County)	
REGIONAL VICINITY MAP	See Appendix G. (U.S.G.S. 7.5 minute series topographic quadrangle Vandergrift, PA, dated 1953 and photorevised in 1969)	
CONSTRUCTION HISTORY	Inferred from information contained in PennDER files. Good historical report dated May 18, 1915. Good photographs (4) from 1909 and 1915.	
AVAILABLE DRAWINGS	No design drawings are available. (See Field Sketch, Figure 1, Appendix F)	
TYPICAL DAM SECTIONS	No design drawings are available.	
OUTLETS: PLAN DETAILS DISCHARGE RATINGS	No design drawings are available. Discharge rating curves are not available.	

## ENGINEERING DATA (CONTINUED)

PAGE 2 OF 5

ITEM	REMARKS	NDI# PA - 453
SPILLWAY: PLAN SECTION DETAILS	No design drawings are available.	
OPERATING EQUIPMENT PLANS AND DETAILS	No design drawings are available.	
DESIGN REPORTS	None available	
GEOLOGY REPORTS	None available	
DESIGN COMPUTATIONS: HYDROLOGY AND HYDRAULICS STABILITY ANALYSES SEEPAGE ANALYSES	No design data, calculations, or reports are available.	
MATERIAL INVESTIGATIONS: BORING RECORDS LABORATORY TESTING FIELD TESTING	None available.	

## ENGINEERING DATA (CONTINUED)

PAGE 3 OF 5

ITEM	REMARKS	NDI# PA - 453
BORROW SOURCES	Not known	
POST CONSTRUCTION DAM SURVEYS	None	
POST CONSTRUCTION ENGINEERING STUDIES AND REPORTS	None, other than ten state inspection reports contained in PennDER files.	
HIGH POOL RECORDS	Not known	
MONITORING SYSTEMS	None	
MODIFICATIONS	Sometime between the years 1902 and 1915 a hole was cut through the face of the spillway and a 24-inch diameter C.I.P. installed (currently non-functional). Present blowoff conduit located at right abutment was installed in 1919. Original outlet works and downstream treatment facilities were disconnected and removed sometime after the facility ceased operations in 1952.	

## ENGINEERING DATA (CONTINUED)

PAGE 4 OF 5

ITEM	REMARKS	NDI#	PA - 453
PRIOR ACCIDENTS OR FAILURES	None recorded.		
MAINTENANCE: RECORDS MANUAL	Facility has not been in operation since 1952. No maintenance is regularly performed on the facility and no records or formal manual are available.		
OPERATION: RECORDS MANUAL	No records or formal manual are available. The facility ceased operations in 1952.		
OPERATIONAL PROCEDURES	Blowoff line at the right abutment discharges continuously and the facility is essentially self-regulating.		
WARNING SYSTEM AND/OR COMMUNICATION FACILITIES	None.		
MISCELLANEOUS			

CHECK LIST  
HYDROLOGIC AND HYDRAULIC  
ENGINEERING DATA

NDI ID # PA-453

PENN DER ID # 65-7

PAGE 5 OF 5

SIZE OF DRAINAGE AREA: 54.4 square miles (total); 10.9 square miles (local)

ELEVATION TOP NORMAL POOL: 843.5 STORAGE CAPACITY: 148

ELEVATION TOP FLOOD CONTROL POOL: -- STORAGE CAPACITY: --

ELEVATION MAXIMUM DESIGN POOL: -- STORAGE CAPACITY: --

ELEVATION TOP DAM: 850.8 STORAGE CAPACITY: 18

SPILLWAY DATA

CREST ELEVATION: 843.5

TYPE: Uncontrolled masonry spillway with concrete-faced overflow  
crest

WIDTH: 100 feet

LENGTH: N/A

SPILOVER LOCATION: 35 feet from right abutment

NUMBER AND TYPE OF GATES: none

OUTLET WORKS

TYPE: 48-inch diameter C.I.P.

LOCATION: Excavated through at base of right abutment

ENTRANCE INVERTS: not known

EXIT INVERTS: not known

EMERGENCY DRAWDOWN FACILITIES: 48-inch diameter gate valve located  
at base of vault in the embankment adjacent the right abutment.

HYDROMETEOROLOGICAL GAGES

TYPE: none

LOCATION: --

RECORDS: --

MAXIMUM NON-DAMAGING DISCHARGE: not known

APPENDIX B

CHECKLIST - VISUAL INSPECTION

CHECK LIST  
VISUAL INSPECTION  
PHASE 1

PAGE 1 OF 8

NAME OF DAM Beaver Dam STATE Pennsylvania COUNTY Westmoreland  
 NDI# PA - 453 PENNER# 65-7  
 TYPE OF DAM Earth SIZE Small HAZARD CATEGORY High  
 DATE(S) INSPECTION 25 May 1979 WEATHER clear and sunny TEMPERATURE 70 @ 2:00 PM  
 POOL ELEVATION AT TIME OF INSPECTION 843.5 M.S.L.  
 TAILWATER AT TIME OF INSPECTION N/A M.S.L.

INSPECTION PERSONNEL	OWNER REPRESENTATIVES	OTHERS
<u>B. M. Mihalcin</u>	<u>Paul Baker (security -</u>	
<u>W. J. Veon</u>	<u>Municipal Authority of</u>	
<u>D. L. Bonk</u>	<u>Westmoreland Dam)</u>	

RECORDED BY D. L. Bonk

# EMBANKMENT

PAGE 2 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
SURFACE CRACKS	None observed.	
UNUSUAL MOVEMENT OR CRACKING AT OR BEYOND THE TOE	The downstream face of the embankment left of the spillway exhibits a change in slope along the toe which may or may not be as constructed.	
SLOUGHING OR EROSION OF EMBANKMENT AND ABUTMENT SLOPES	The downstream slope of the embankment right of the spillway is fairly steep and shows signs of erosion behind the wingwalls. Minor erosion is evident across the entire embankment and can generally be attributed to a lack of proper upkeep.	
VERTICAL AND HORIZONTAL ALIGNMENT OF THE CREST	Vertical - good Horizontal - irregular with a temporary construction road cut through the left embankment near the left abutment.	
RIPRAP FAILURES	No riprap observed.	
JUNCTION OF EMBANKMENT AND ABUTMENT, SPILLWAY AND DAM	Good	

EMBANKMENT

PAGE 3 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
DAMP AREAS IRREGULAR VEGETATION (LUSH OR DEAD PLANTS)	None observed. Reservoir is almost completely silted and stores little water.	
ANY NOTICEABLE SEEPAGE	None observed.	
STAFF GAGE AND RECORDER	None observed.	
DRAINS	None observed.	

## OUTLET WORKS

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
INTAKE STRUCTURE	Semi-circular masonry structure located approximately 100 feet upstream of the embankment to the right of the spillway. Heavy quantities of silt, much, and dried leaves have covered most of the structure such that the inlet could not be observed.	
OUTLET CONDUIT (CRACKING AND SPALLING OF CONCRETE SURFACES)	Entire outlet conduit is located underground in rock at the right abutment and was not observable.	
OUTLET STRUCTURE	None. Flow discharges through 48-inch C.I.P. laid in a tunnel cut through rock within right abutment.	
OUTLET CHANNEL	The outlet conduit discharges behind the downstream end of the right wingwall of the spillway and into the natural stream below the dam.	
GATE(S) AND OPERATIONAL EQUIPMENT	A single valve control mechanism is located in a circular masonry vertical vault located in the embankment adjacent the right abutment. The vault contains no cover, ladder, or floor stand making access to and operation of the valve impractical.	

# EMERGENCY SPILLWAY

PAGE 5 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
TYPE AND CONDITION	Uncontrolled masonry spillway with a concrete-faced overflow section and masonry wingwalls located about 35 feet from the right abutment.	
APPROACH CHANNEL	50- to 100-foot wide channel formed as a result of heavy reservoir siltation. Channel bottom is composed of a deep layer of very soft silt.	
SPILLWAY CHANNEL AND SIDEWALLS	Concrete-faced overflow section showed no signs of deterioration. Forebay is completely silted. Cracking, particularly along the mortar joints, but, also in the blocks themselves, was evident in both wingwalls.	
STILLING BASIN PLUNGE POOL	Located immediately below the spillway, the plunge pool was completely submerged and not observed.	
DISCHARGE CHANNEL	Natural stream (Beaver Run) about 100 feet wide immediately below the spillway and narrowing to about 50 feet wide several hundred feet downstream.	
BRIDGE AND PIERS	None.	
EMERGENCY GATES	None.	

## SERVICE SPILLWAY

PAGE 6 OF 8

NDI# PA - 453

ITEM	OBSERVATIONS AND/OR REMARKS
TYPE AND CONDITION	N/A
APPROACH CHANNEL	N/A
OUTLET STRUCTURE	N/A
DISCHARGE CHANNEL	N/A

## INSTRUMENTATION

PAGE 7 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
MONUMENTATION SURVEYS	None observed.	
OBSERVATION WELLS	None observed.	
WEIRS	None observed.	
PIEZOMETERS	None observed.	
OTHERS		

## RESERVOIR AREA AND DOWNSTREAM CHANNEL

PAGE 8 OF 8

ITEM	OBSERVATIONS AND/OR REMARKS	NDI# PA - 453
SLOPES: RESERVOIR	Steep and heavily forested. Recent highway construction along the right hillside has resulted in many felled trees strewn across the slope.	
SEDIMENTATION	Reservoir is almost completely silted.	
DOWNSTREAM CHANNEL (OBSTRUCTIONS, DEBRIS, ETC.)	Approximately 2000 feet downstream of the embankment, Beaver Run passes beneath a small concrete bridge for a local road. This is one of three road bridges that serve as potential channel obstructions between the embankment and Kiskiminetas River.	
SLOPES: CHANNEL VALLEY	Steep and heavily forested valley slopes.  The channel flows on an approximately nine percent grade.	
APPROXIMATE NUMBER OF HOMES AND POPULATION	The first downstream residences are located about 1500 feet downstream of the embankment. Five homes are located within a 500-foot stretch in this area. At a distance of about 1-mile downstream of the embankment, Beaver Run flows into the Kiskiminetas River, the banks of which are lined with residential and industrial developments as the river flows past the communities of Apollo and Vandergrift.	

APPENDIX C  
HYDROLOGY AND HYDRAULICS

## PREFACE

The modified HEC-1 program is capable of performing two basic types of hydrologic analyses: 1) the evaluation of the overtopping potential of the dam; and 2) the estimation of the downstream hydrologic-hydraulic consequences resulting from assumed structural failures of the dam. Briefly, the computational procedures typically used in the dam overtopping analysis are as follows:

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir to determine if the event(s) analyzed would overtop the dam.
- c. Routing of the outflow hydrograph(s) from the reservoir to desired downstream locations. The results provide the peak discharge(s), time(s) of the peak discharge(s), and the maximum stage(s) of each routed hydrograph at the downstream end of each reach.

The evaluation of the hydrologic-hydraulic consequences resulting from an assumed structural failure (breach) of the dam is typically performed as shown below.

- a. Development of an inflow hydrograph(s) to the reservoir.
- b. Routing of the inflow hydrograph(s) through the reservoir.
- c. Development of a failure hydrograph(s) based on specified breach criteria and normal reservoir outflow.
- d. Routing of the failure hydrograph(s) to desired downstream locations. The results provide estimates of the peak discharge(s), time(s) to peak and maximum water surface elevations of failure hydrographs for each location.

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-24-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 1 OF 14



### DAM STATISTICS

HEIGHT OF DAM  $\approx$  32 FT (FIELD MEASURED)  
(FROM SPILLWAY TOE TO LOW TOP OF EMBANKMENT)

MAXIMUM POOL STORAGE CAPACITY  $\approx$  148 AC-FT (SHEET 4)  
@ TOP OF DAM

NORMAL POOL STORAGE CAPACITY  $\approx$  18 AC-FT (SEE NOTE 1)

DRAINAGE AREA  $\approx$  54.4 SQ.MI (TOTAL)\*  
 $\approx$  10.9 SQ.MI. (LOCAL)

LOCAL AREA  
PLANIMETERED OFF USGS  
7.5 MINUTE VANDECKRIFT  
AND SLICKVILLE, PA QUADS

\* SEE APPENDIX C-1, SHEET 1 OF 20, BEAVER RUN DAM  
CALCULATIONS

NOTE 1: ALTHOUGH THE ORIGINAL NORMAL POOL STORAGE CAPACITY OF THE RESERVOIR WAS ABOUT 70 MILLION GALLONS OR APPROXIMATELY 215 AC-FT ACCORDING TO "REPORT UPON THE BEAVER RUN DAM OF THE APOLLO WATER WORKS COMPANY LOCATED ON BEAVER RUN, WASHINGTON TOWNSHIP, WESTMORELAND COUNTY, PA." AS FOUND IN PENN DER FILES, THE FACILITY IS PRESENTLY VIRTUALLY FILLED WITH SILT. THEREFORE, THE DESIGN CAPACITY IS FRIVOLOUS AND CANNOT BE USED IN CALCULATIONS. REFER TO SHEET 2 FOR STORAGE ASSUMPTIONS.

### DAM CLASSIFICATIONS

DAM SIZE - SMALL (REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF -  $\frac{1}{2}$  PMF TO PMF (REF 1, TABLE 2)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-25-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 2 OF 14



### HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE  $\approx$  8.0 MI

$L_{CA} \approx 3.8$  MI. (MEASURED ALONG THE LONGEST WATERCOURSE  
FROM THE DAM TO THE CENTROID OF THE BASIN)

NOTE 2: VALUES OF L AND  $L_{CA}$  ARE MEASURED FROM THE  
USGS 7.5 MINUTE VANDERGRIFF AND SLICKVILLE, PA  
QUADS. ALL VARIABLES ARE DEFINED IN REF. 2  
IN THE SECTION ENTITLED, "SNYDER SYNTHETIC  
UNIT HYDROGRAPH"

$$\left. \begin{array}{l} C_t \approx 1.6 \\ C_p \approx 0.45 \end{array} \right\} \left[ \begin{array}{l} \text{SUPPLIED BY COE; ZONE 24} \\ \text{OHIO RIVER BASIN} \end{array} \right]$$

$$t_p = \text{SNYDER'S STANDARD LAG} \approx 1.6 (L \times L_{CA})^{0.3}$$

$$\therefore t_p \approx 1.6 (8.0 \times 3.8)^{0.3} \approx 4.46 \text{ HRS}$$

### RESERVOIR SURFACE AREAS AND STORAGE VOLUMES

SURFACE AREA (SA) @ NORMAL POOL EL 343.5 FT  $\approx$  12 AC  
(ORIGINALLY)

NOTE 3: SINCE DESIGN DRAWINGS WERE NOT AVAILABLE  
FOR THIS FACILITY, THE NORMAL POOL OR SPILLWAY  
CREST ELEVATION WAS ASSUMED FROM A COMBINATION  
OF FIELD MEASUREMENTS AND THE VANDERGRIFF, PA  
QUAD. THE 12 AC SA @ NORMAL POOL WAS OBTAINED  
FROM THE REFERENCE OF NOTE 1 (SHEET 1). THE PRESENT  
WATER SA IS SOMEWHAT LESS THAN THIS VALUE DUE  
TO THE SILTATION PROBLEM OF THE RESERVOIR. SOME

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 5-30-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 3 OF 14



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PORTIONS OF THE RESERVOIR HAVE LANDFORMS ABOVE THE NORMAL POOL WATER SURFACE, WHILE OTHER PORTIONS ARE PROBABLY DEEPER THAN SAY 1.5 FT. HOWEVER, IN ORDER TO ESTABLISH A REPRESENTATIVE STORAGE VALUE BELOW EL 843.5 FT, A CONSTANT DEPTH OF 1.5 FT OF WATER WILL BE ASSUMED TO COVER THE ENTIRE 12 AC AREA @ NORMAL POOL. THEREFORE, THE STORAGE VOLUME @ NORMAL POOL EL 843.5 FT  $\approx (1.5 \text{ FT})(12 \text{ AC}) \approx 18 \text{ AC-FT}$

SA @ EL 860 FT  $\approx 37.6 \text{ AC}$

SA @ EL 880 FT  $\approx 70.7 \text{ AC}$

[ PLANIMETERED FROM THE  
 USGS VANDERGRIFF, PA  
 QUAD ]

- ASSUME THE MODIFIED PRISMOIDAL FORMULA (REF 14, PG 15) CAN REPRESENT THE ACTUAL RELATIONSHIP BETWEEN RESERVOIR LEVEL AND VOLUME FOR BEAVER DAM RESERVOIR:

$$\Delta V_{1 \rightarrow 2} \approx \frac{H}{3} (A_1 + A_2 + \sqrt{A_1 \times A_2})$$

WHERE  $\Delta V_{1 \rightarrow 2}$  = INCREMENTAL VOLUME BETWEEN ELEVATIONS 1 AND 2, IN AC-FT;

H = ELEVATION 2 - ELEVATION 1, IN FT;

A<sub>1</sub> = SA @ ELEVATION 1, IN AC; AND

A<sub>2</sub> = SA @ ELEVATION 2, IN AC.

ALSO,  $A_c = A_0 + (\Delta A / \Delta H \times H)$

WHERE A<sub>c</sub> = SA @ ELEVATION c, IN FT;

A<sub>0</sub> = 12 AC FOR ELEVATION c < 860 FT, AND  
 37.6 AC FOR ELEVATION c > 860 FT BUT < 880 FT;

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
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$\Delta A / \Delta H$  = RATE OF SURFACE AREA CHANGE PER FOOT OF  
 RESERVOIR RISE  $\Rightarrow \Delta A / \Delta H \approx \frac{(37.6 - 12.0) AC}{(860 - 843.5) FT} \approx 1.6 \frac{AC}{FT}$   
 FOR ELEVATION  $L < 860$  FT, AND  $\Delta A / \Delta H \approx \frac{(70.7 - 37.6)}{(880 - 860) FT}$   
 $\approx 1.7 \frac{AC}{FT}$  FOR ELEVATION  $L > 860$  FT BUT  $< 880$  FT, AND  
 $H$  = ELEVATION  $L$  - 843.5 FT FOR ELEVATION  $L$   
 $< 860$  FT, AND  $H$  = ELEVATION  $L$  - 860 FT FOR  
 ELEVATION  $L < 860$  FT BUT  $> 880$  FT

- ELEVATION - STORAGE RELATIONSHIP :

	ELEVATION (FT)	A <sub>L</sub> (AC)	$\Delta V_{1-2}$ (AC-FT)	TOTAL VOLUME	
				MODIFIED PRISMATICAL (AC-FT)	ASSUMED # (AC-FT)
	842.0	-	-	-	0
	843.0	-	-	-	12
NORMAL POOL -	843.5	12.0	0	18	18
	844.5	13.6	12	31	
	845.5	15.2	14	45	
	846.5	16.8	16	61	
	847.5	18.4	18	79	
	848.5	20.0	19	98	
	849.5	21.6	21	119	
LOW TOP OF DAM -	850.8	23.7	29	143	
	852.0	25.6	30	173	
	854.0	28.8	54	232	
	856.0	32.0	61	293	
	858.0	35.2	67	360	
	860.0	37.6	73	433	
	862.0	41.0	79	512	
	864.0	44.4	85	597	
	866.0	47.8	92	639	
	868.0	51.2	99	738	

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-31-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 5 OF 14



### PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 24 IN (REF 3, FIG 1)  
(CORRESPONDING TO A DURATION OF 24 HR  
AND AN AREA OF 200 SQ. MI. LOCATED IN  
SOUTHWESTERN PENNSYLVANIA)
- DEPTH - AREA - DURATION ZONE #7 (REF 3, FIG 1)
- LOCAL DRAINAGE AREA  $\approx$  10.9 SQ. MI. HOWEVER, THE  
STORM WILL BE CENTERED OVER THE TOTAL DRAINAGE  
AREA ABOVE BEAVER DAM  $\approx$  54.4 SQ. MI.  $\Rightarrow$

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	85
12	103
24	113
48	124

(FROM REF 3,  
FIG 2)

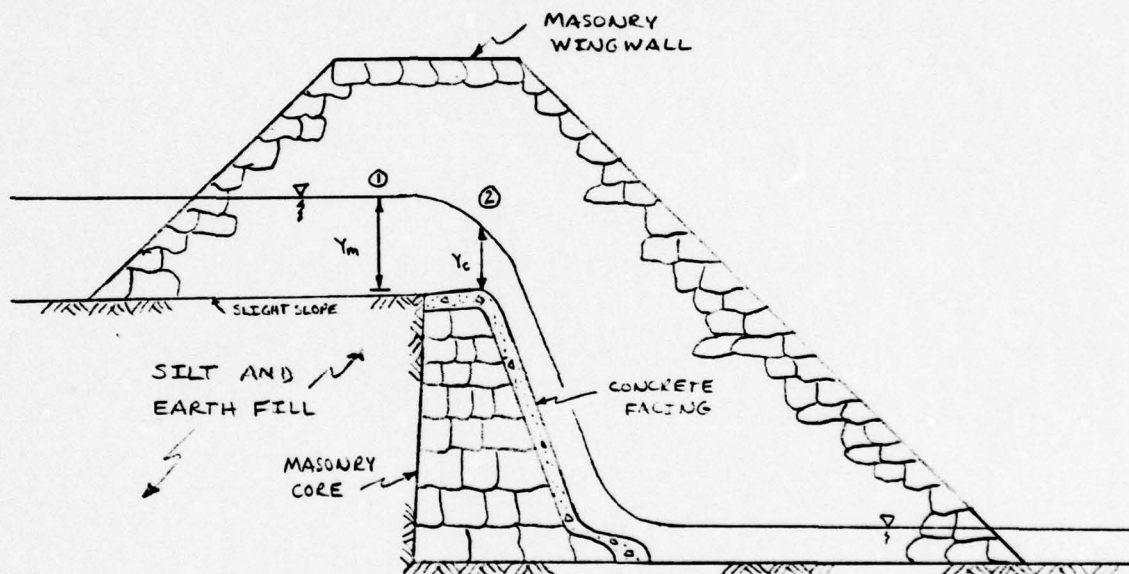
- HOP BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL  
AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM  
CENTERING OVER A SMALLER BASIN) CORRESPONDING TO  
A DA  $\approx$  54.4 SQ MI  $\Rightarrow$  0.852 (AS COMPUTED BY HEC-1)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 5-31-79 PROJ. NO. 73-617-452  
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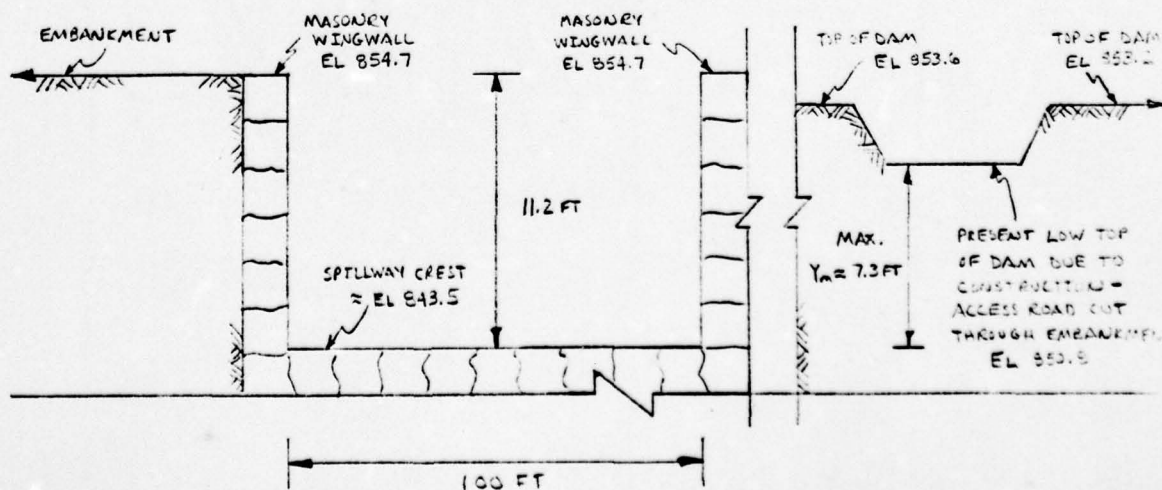
**gai**  
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## SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)  
 (FROM FIELD MEASUREMENT AND OBSERVATION, AND REF IN NOTE 1)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)  
 (FROM FIELD MEASUREMENTS AND OBSERVATION, AND REF IN NOTE 1)



SECTION LOOKING US TOWARD DAM

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-1-79 PROJ. NO. 79-617-453  
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- THE DISCHARGE OVER THE FREE OVERFALL SPILLWAY HAS BEEN REDUCED TO CRITICAL FLOW CONTROL DUE TO THE SILTATION OF THE FOREBAY OF THE OGEE-LIKE SPILLWAY WEIR.

∴ CRITICAL FLOW WILL OCCUR @ SECTION ② (SEE SKETCH ON SHEET 6) DUE TO THE ABRUPT CHANGE FROM AN US ADVERSE SLOPE TO A DS SUPERCRITICAL SLOPE. THE CRITICAL DEPTH WILL OCCUR @ ②, WHILE THE MAXIMUM RESERVOIR DEPTH (ABOVE THE SPILLWAY CREST) PRIOR TO OVERTOPPING OF THE DAM ( $Y_m \approx 7.3$  FT) WILL OCCUR @ SECTION ①

- ENERGY BALANCE BETWEEN ① AND ② :

$$Y_m + \frac{v_a^2}{2g} + z_1 = Y_c + \frac{v_c^2}{2g} + z_2 + H_L \quad (\text{REF 7, PG 40})$$

WHERE  $v_a \approx$  RESERVOIR VELOCITY OF APPROACH  $\approx 0$  FPS ;  
 $z_1 = z_2 =$  ELEVATION DATUM = ELEVATION OF SPILLWAY CREST, IN FT ( $z_1 - z_2 = 0$ ) ;  
 $v_c \approx$  CRITICAL VELOCITY, IN FPS ; AND  
 $H_L \approx$  APPROACH CHANNEL HEAD LOSS  $\approx 0$  FT

(ALTHOUGH  $v_a$  AND  $H_L$  ARE PROBABLY NOT REALLY EQUAL TO 0, IT IS ASSUMED THAT THEIR ACTUAL VALUES WOULD BE SUCH THAT THE  $\frac{v_a^2}{2g}$  QUANTITY WOULD CANCEL THE  $H_L$  QUANTITY  $\Rightarrow$  SAME RESULT AS THE "0" VALUE ASSUMPTION)

$$\therefore Y_m \approx 7.3 \text{ FT} \approx Y_c + \frac{v_c^2}{2g}$$

- SINCE THE CRITICAL SECTION IS RECTANGULAR IN SHAPE :

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BEAVER DAM  
BY WJV DATE 6-1-79 PROJ. NO. 73-617-453  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 8 OF 14



$$v_c^2 / 2g = Y_c / 2$$

(REF 13, PG 143)

$$\therefore 7.3 \text{ FT} \approx Y_c + v_c^2 / 2g \approx Y_c + Y_c / 2 \approx \frac{3}{2} Y_c$$

$$Y_c \approx 4.9 \text{ FT}$$

$$\begin{aligned} - \text{ SINCE } Y_c \approx 4.9 \text{ FT} \Rightarrow A_c &\approx (100 \text{ FT})(Y_c) \approx (100)(4.9) \approx 490 \text{ FT}^2 \\ v_c &\approx \sqrt{(Y_c / 2) 2g} \approx \sqrt{g Y_c} \approx \sqrt{g(4.9)} \\ &\approx 12.6 \text{ FPS} \end{aligned}$$

$$\therefore \text{ CAPACITY OF SPILLWAY} = Q = A_c v_c \approx (490 \text{ FT}^2)(12.6 \text{ FPS}) \approx 6170 \text{ CFS}$$

### SPILLWAY RATING CURVE

COMPUTED INTERNALLY BY HEC-1 VIA THE TRAPEZOIDAL RATING CURVE ROUTINE, BASED ON THE SPILLWAY GEOMETRY PRESENTED ON SHEET 6. THE TRAPEZOIDAL ROUTINE CALCULATES CRITICAL CONTROL DISCHARGES IN A WAY SIMILAR TO THAT OUTLINED ON SHEETS 7 AND 8. (SEE SUMMARY INPUT / OUTPUT SHEETS)

### DAM EMBANKMENT RATING CURVE

- FLOWS OVER THE EMBANKMENT WILL BE COMPUTED INTERNALLY BY HEC-1 VIA THE ASSUMPTION THAT CRITICAL DEPTH OCCURS ON THE CREST W/ THE CREST PROFILE REPRESENTED BY A SERIES OF TRAPEZOIDS. (SEE SUMMARY INPUT / OUTPUT SHEETS).

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

BY WJV DATE 6-1-79 PROJ. NO. 78-617-453

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- PRESENTLY A SMALL "DIRT ROAD" IS CUT THROUGH THE EMBANKMENT AT ABOUT 40 FT FROM THE LEFT ABUTMENT. THE PRESENCE OF THIS CUT HAS LOWERED THE PREVIOUS LOW TOP OF DAM BY AN ADDITIONAL 1.7 FT. THIS ROAD CUT WILL BE CONSIDERED IN THIS ANALYSIS.

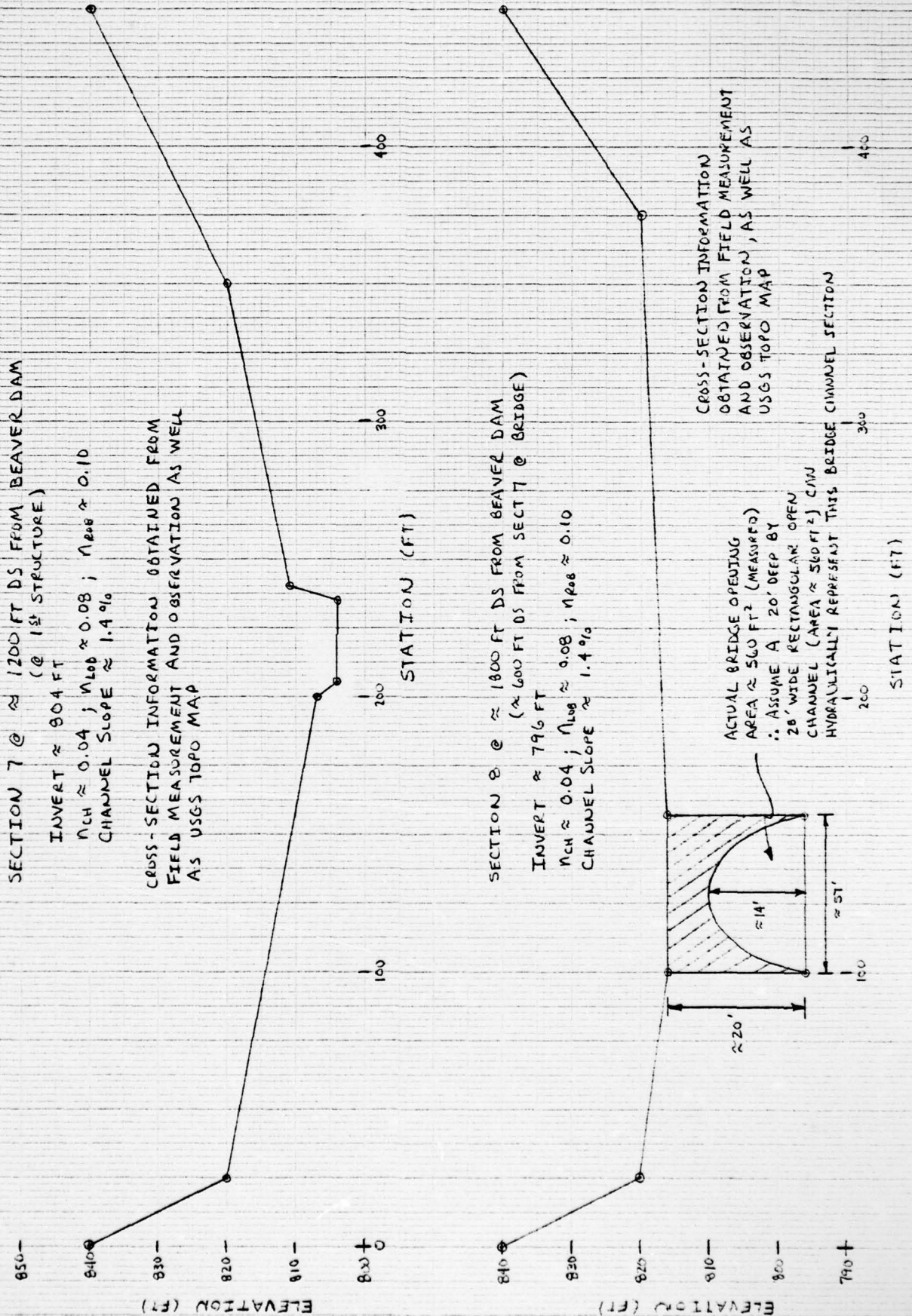
- INPUT INFORMATION : (BASED ON FIELD MEASUREMENTS)

RESERVOIR ELEVATION (FT)	DEPTH OF WATER ABOVE CREST (FT)	LENGTH OF CREST INUNDATED (FT)
850.8	0	0
851.3	0.5	20
852.5	1.7	20
853.0	2.2	45
853.2	2.4	95
853.3	2.5	150
853.5	2.7	190
853.6	2.8	225
854.5	3.7	250
854.7	3.9	285
860.0	9.2	305
868.0	17.2	340

} ASSUMED BASED ON STEEP  
VALLEY SIDE SLOPES  
≈ (2H:1V)

# DOWNSTREAM ROUTING SECTIONS

SHEET 10 OF 14

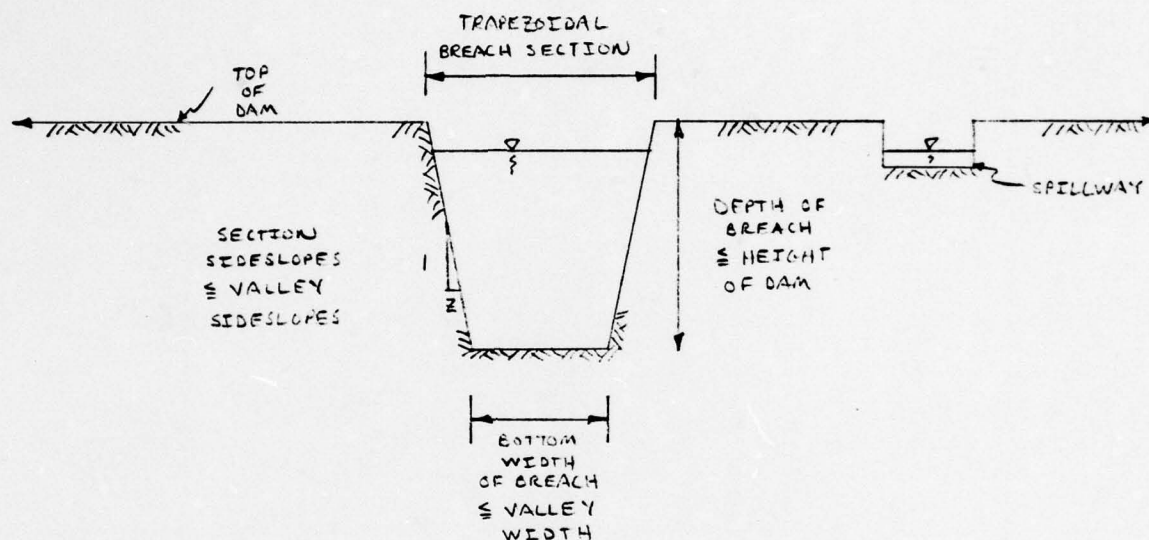


SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-26-79 PROJ. NO. 73-617-453  
 CHKD. BY DLB DATE 7-2-79 SHEET NO. 11 OF 14

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## BREACH ASSUMPTIONS

- TYPICAL BREACH SECTION:



- HEC-1- DAM BREACHING ANALYSIS INPUTS:

(ALL BREACHING WILL BEGIN WHEN THE RESERVOIR LEVEL REACHES THE LOW TOP OF DAM ELEVATION)

* PLAN NUMBER AND COMMENT	BREACH BOTTOM WIDTH (FT)	MAX BREACH DEPTH (FT)	SECTION SIDESLOPES	* BREACH TIME (HR)	WSFL @ START OF FAILURE (FT)
① MIN. BREACH SECT; MIN FAIL TIME	0	8	1/2 TO 1	1.0	950.9
② MAX. BREACH SECT; MIN FAIL TIME	200	8	2 TO 1	1.0	950.9
③ MIN. BREACH SECT; MAX FAIL TIME	0	8	1/2 TO 1	4.0	950.9
④ MAX. BREACH SECT; MAX FAIL TIME	200	8	2 TO 1	4.0	950.9
⑤ AVERAGE POSSIBLE CONDITIONS	100	8	1 TO 1	2.0	950.9
** ⑥ AVERAGE POSSIBLE CONDITIONS	100	25	1 TO 1	2.0	950.9

\* BREACH TIME = TOTAL TIME NECESSARY TO REACH FINAL BREACH DIMENSIONS

\*\* PLANS ① → ⑤ WILL BE UNDER THE ASSUMPTION THAT THE SILT BEHIND THE DAM DOES NOT MOVE UPON BREACHING, PLAN ⑥ WILL ASSUME THAT THE SILT WILL ALSO FLOW

SUBJECT DAM SAFETY INSPECTIONBEAVER DAMBY WJV DATE 6-26-79 PROJ. NO. 79-617-453CHKD. BY DLB DATE 7-2-79 SHEET NO. 12 OF 14Engineers • Geologists • Planners  
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- THE BREACH ASSUMPTIONS LISTED ON SHEET 11 ARE BASED SOMEWHAT ON INFORMATION CONCERNING EARTH DAM BREACHING PROVIDED BY THE COE, BALTIMORE DISTRICT; AND ALSO ON THE PHYSICAL CONSTRAINTS OF THE DAM AND SURROUNDING TERRAIN:

CONSTRAINT	VALUE
- MAXIMUM HEIGHT OF EMBANKMENT	≈ 32 FT
AVERAGE HEIGHT OF EMBANKMENT	≈ 25 FT
DEPTH OF EMBANKMENT TO TOP OF DEPOSITED SILT	≈ 9 FT
	} FIELD MEASURED
- EMBANKMENT CREST LENGTH:	
LENGTH TO LEFT OF SPWY	≈ 250 FT
LENGTH TO RIGHT OF SPWY	≈ 35 FT
	} FIELD MEASURED
- VALLEY BOTTOM WIDTH:	
@ DEPOSITED SILT ELEVATION	≈ 395 FT (FIELD MEASURED)
@ 25 FT BELOW TOP OF DAM	≈ 200 FT (FIELD OBSERVATION)
- VALLEY SIDESLOPES ADJACENT TO DAM:	
RIGHT WALL	≈ 2H TO 1V
LEFT WALL	≈ 2H TO 1V
	} USGS TOPO MAP

- IN ORDER TO EVALUATE THE POSSIBILITY (OR PROBABILITY) THAT THE DEPOSITED SILT WILL ALSO FLOW DURING EMBANKMENT BREACHING, THE ESTIMATED VOLUME OF SILT BEHIND THE DAM (≈ 200 AC-FT, FROM REF IN NOTE 1, SHEET 1) MUST BE ADDED TO THE RESERVOIR STORAGE VALUES ON SHEET 4 W/ "0" STORAGE ELEVATION ≈ 518.8 FT

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-29-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 7-2-79 SHEET NO. 13 OF 14



# HEC-1-DAM BREACHING ANALYSIS OUTPUT:

## RESERVOIR DATA

UNDER 0.38 PMF BASE FLOW CONDITIONS (W/ BOTH BEAVER RUN AND GILKERSON DAMS ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING). ASSUME THE SILT BEHIND THE DAM DOES NOT MOVE UPON BREACHING.

PLAN NUMBER	VARIABLE	ACTUAL MAX FLOW DURING FAILURE TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	INTERPOLATED HEC-1 ROUTED MAX FLOW DURING FAILURE TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HR)	TIME OF INITIAL BREACH (HR)
①	0	6399	45.33	6399	45.33	6471	46.67	44.33
②	200	7558	45.33	7558	45.33	7558	45.33	44.33
③	0	6493	46.50	6491	46.67	6493	46.50	44.33
④	200	6777	46.42	6774	46.33	6777	46.42	44.33
⑤	100	6974	46.33	6974	46.33	6974	46.33	44.33

UNDER 0.38 PMF BASE FLOW CONDITIONS (W/ BOTH BEAVER RUN AND GILKERSON DAMS ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING). ASSUME THE SILT BEHIND THE DAM FLOWS UPON BREACHING.

PLAN NUMBER	VARIABLE	ACTUAL MAX FLOW DURING FAILURE TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	INTERPOLATED HEC-1 ROUTED MAX FLOW DURING FAILURE TIME (CFS)	CORRESPONDING TIME OF FLOW (HR)	ACTUAL PEAK FLOW THROUGH DAM (CFS)	CORRESPONDING TIME OF PEAK (HR)	TIME OF INITIAL BREACH (HR)
⑥	100	7983	45.59	7948	45.33	7983	45.59	44.33

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

BY WJV DATE 6-30-79 PROJ. NO. 73-617-453

CHKD. BY DLB DATE 7-2-79 SHEET NO. 14 OF 14



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# HEC-1-DAM BREACHING ANALYSIS OUTPUT:

## DOWNSTREAM ROUTING DATA

UNDER 0.38 PMF BASE FLOW CONDITIONS (W/ BOTH BEAVER RUN AND GILKERSON DAMS ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING). ASSUME THE SILT BEHIND THE DAM DOES NOT MOVE UPON BREACHING.

PLAN NUMBER	VARIABLE BREACH BOTTOM WIDTH (FT)	OUTPUT @ SECTION 7 LOCATED 1200 FT DS OF DAM				OUTPUT @ SECTION 8 LOCATED 1800 FT DS OF DAM			
		1. PEAK FLOW (CFS)	2. CORRESPONDING WSEL (FT)	3. WSEL W/O BREACH (FT)	4. ΔELEV (FT)	1. PEAK FLOW (CFS)	2. CORRESPONDING WSEL (FT)	3. WSEL W/O BREACH (FT)	4. ΔELEV (FT)
①	0	6472	812.7	812.7	0.0	6473	809.8	809.8	0.0
②	200	7575	812.4	812.7	+0.7	7589	811.5	809.8	+1.7
③	0	6482	812.7	812.7	0.0	6482	809.8	809.8	0.0
④	200	6776	812.9	812.7	+0.2	6776	810.3	809.8	+0.5
⑤	100	6973	813.0	812.7	+0.3	6973	810.6	809.8	+0.8

UNDER 0.35 PMF BASE FLOW CONDITIONS (W/ BOTH BEAVER RUN AND GILKERSON DAMS ABLE TO PASS THE ENTIRE FLOOD WITHOUT BREACHING). ASSUME THE SILT BEHIND THE DAM WILL FLOW UPON BREACHING.

⑥	100	7412	812.6	812.7	+0.9	7922	812.0	809.8	+2.2
---	-----	------	-------	-------	------	------	-------	-------	------

1. SEE TABLE ON SHEET 11. 2. WATER SURFACE ELEVATIONS CORRESPONDING TO BREACH FLOWS, FROM SUMMARY INPUT/OUTPUT SHEETS. 3. BASE FLOW ELEVATIONS CORRESPONDING TO THE PEAK 0.35 PMF, FROM SUMMARY INPUT/OUTPUT SHEETS. 4. ΔELEV CORRESPONDING WSEL - WSEL W/O BREACH.

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAM

BY WJV

DATE 7-2-79

PROJ. NO. 78-617-453

CHKD. BY DLB

DATE 7-2-79

SHEET NO. A OF EE

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## SUMMARY INPUT/OUTPUT SHEETS

DAM SAFETY INSPECTION  
BEAVER DAM W/ US BEAVER RUN DAM AND GILKINSON DAM \*\*\*  
10-MINUTE TIME STEP AND 48-HOUR STORM DURATION

\*\*\* OVERTOPPING ANALYSIS \*\*\*

NO NHR NMN IDAY ITH IMIN METRC IPLT IPRT NSTAN  
288 0 20 0 0 0 0 0 0 0  
JOPER 5 0 0 0 0 0 0 0 0 0

MULTI-PLAN ANALYSES TO BE PERFORMED

RTIOS= .20 .30 .40 .50 1.00  
MPLAN= 1 NRTIO= 5 LRTIO= 1

\*\*\*\*\*

\*\*\*\*\*

\*\*\*\*\*

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW INTO BEAVER RUN DAM RESERVOIR

ISTAQ ICUMP IECON ITAPE UPLT JPRT INAME ISTAGE IAUTO  
1 0 0 0 0 0 0 1 0 0

## HYDROGRAPH DATA

IHYD IUNG TAREA SNAP TRSDA TRSPC RATIO ISNOW ISAME LOCAL  
1 1 43.20 0.00 54.40 0.00 0.000 0 1 0

## PRECIP DATA

SPEE PMS R6 R12 R24 R48 R72 R96  
0.00 24.00 85.00 103.00 113.00 124.00 0.00 0.00

TRSPC COMPUTED BY THE PROGRAM IS .852  
INITIAL AND CONSTANT RAINFALL  
LOSSES AS PER COE

## LOSS DATA

LROPT STRAN DLTAR RTIOL ERRAIN STRNS RTION STNLT CNSTL ALSMX RTIMP  
0 0.00 0.00 1.00 1.00 0.00 1.00 1.00 0.00 0.00 0.00

## UNIT HYDROGRAPH DATA

TP= 6.17 CP= .45 NTA= 0

## BASE FLOW PARAMETERS

AS PER COE

## RECESSION DATA

STNLT= -1.50 GRCSME = .95 RTIOE= 2.00

APPROXIMATE CLARA COEFFICIENTS FROM GIVEN SNIDEY CP AND TP ARE TC=19.22 AND R=29.45 INTERVALS

# DAM SAFETY INSPECTION

## BEAVER DAM

BY: WJV

DATE 7-2-79

PROJ. NO. 79-617-453

CHKD. BY DLP

DATE 7-2-7

SHEET NO. 3 OF 55



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SUBJECT DAM SAFETY INSPECTIONBEAVER DAMBY WJVDATE 7-2-79PROJ. NO. 79-617-453CHKD. BY DLBDATE 7-2-79SHEET NO. C OF EEEngineers • Geologists • Planner  
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## HYDROGRAPH ROUTING

## ROUTE LOCAL INFLOW THROUGH BEAVER RUN DAM RESERVOIR

STAGE	1050.00	1051.00	1052.00	1053.00	1054.00	1054.30	1055.00	1060.00	1065.00
	1071.00	1072.00	1073.00	1074.00	1075.00	1076.00	1077.00	1078.00	
FLOW	0.00	310.00	920.00	1760.00	2730.00	3090.00	3100.00	3230.00	3340.00
	3640.00	4120.00	4960.00	6220.00	7930.00	12770.00	20190.00	29420.00	
CAPACITY-	0	220	1410-	2830-	4780-	7170-	10400-	13900-	23000-
	28000-	34000-	41000-	48000-	56000-	64600-	74600-	80600-	
ELEVATION=	988-	995-	1005-	1010-	1015-	1020-	1025-	1030-	1040-
	1035-	1050-	1055-	1060-	1065-	1070-	1075-	1078-	

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

BY WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY DLB

DATE

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PEAK OUTFLOW IS 3213. AT TIME 62.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3213.	3212.	3200.	2382.	515215.
91.	91.	91.	67.	14589.
	.69	2.76	6.15	6.16
	17.57	70.02	156.32	156.55
	1593.	6348.	14173.	14193.
	1965.	7830.	17482.	17507.

0.4 PMF

PEAK OUTFLOW IS 3276. AT TIME 64.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3276.	3276.	3267.	2478.	536082.
93.	93.	93.	70.	15180.
	.71	2.81	6.40	6.41
	17.92	71.47	162.61	162.89
	1624.	6479.	14742.	14768.
	2004.	7992.	18184.	18216.

0.5 PMF

## HYDROGRAPH ROUTING

ROUTE FROM BEAVER RUN DAM TO SECTION 2 \* 7700 FT DS FROM BEAVER RUN DAM

ISTAQ	ICUMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
102	1	0	0	0	0	1	0	0
OLUSS	CLOSS	AVG	ROUTING DATA	IOPT	IPMP		LSTR	
0.0	0.000	0.00	ISAME	1	0		0	
			LAG	ANSKK	X	TSK	STORA	ISPRAT
			0	0.000	0.000	0.000	-1.	0

## NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELNVT	ELMAX	RLNTH	SEL
.0800	.0350	.0900	966.0	1000.0	7700.	.00200

CROSS SECTION COORDINATES--STA, ELEV, STA, ELEV--ETC

50.00	1000.00	100.00	980.00	150.00	970.00
170.00	970.00	250.00	980.00	500.00	1000.00

BEAVER RUN

DAM

OUTFLOW

HYDROGRAPHS



SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

78-617-453

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0.5 PMF

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
3276.	3276.	3267.	2456.	531348.
93.	93.	92.	70.	15046.
	.71	2.81	6.35	6.36
	17.92	71.47	161.22	161.45
	1624.	6479.	14617.	14638.
	2004.	1992.	18030.	18055.

MAXIMUM STORAGE = 134.

MAXIMUM STAGE IS 978.9

## HYDROGRAPH ROUTING

ROUTE FROM SECTION 2 TO SECTION 3 &amp; 27700 FT DS FROM BEAVER RUN DAM

ISTAQ	ICOMP	IECON	IIAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
203	1	0	0	0	0	1	0	0
CROSS	AVG	INES	ISAME	IOPT	IPMP		LSTR	
0.0	0.00	1	1	0	0		0	
NSTPS	NSTD	LAG	AMSK	X	TSK	STORA	ISPRAT	
1	0	0	0.00	0.00	0.00	-1.	0	

## NORMAL DEPTH CHANNEL ROUTING

ON(1)	ON(2)	ON(3)	ELNVT	ELMAX	RLNTH	SEL
.1000	.0350	.1000	846.0	880.0	20000.	.00900

CROSS SECTION COORDINATES--STA, ELEV, STA, ELEV--ETC

STA	ELEV	STA	ELEV
50.00	880.00	200.00	860.00
320.00	850.00	400.00	860.00
		420.00	880.00

STORAGE	OUTFLOW	STAGE	FLOW
0.00	0.00	846.00	0.00
919.84	17441.38	863.89	17441.38
10.05	22269.49	847.79	110.26
1117.61	22269.49	865.68	22269.49
23.78	376.47	849.58	376.47
1327.88	27710.49	867.47	27710.49
47.85	33773.97	851.37	376.47
1550.65	33773.97	869.26	27710.49
1785.91	40471.19	871.05	27710.49
174.12	2909.40	854.95	376.47
2033.67	47814.52	872.84	27710.49
276.95	4577.68	856.74	376.47
2293.93	55817.10	874.63	27710.49
406.25	6774.06	858.53	376.47
2566.68	64492.64	876.42	27710.49
561.79	9599.50	860.32	376.47
2851.93	73855.23	878.21	27710.49
406.25	6774.06	858.53	376.47
2566.68	64492.64	876.42	27710.49
561.79	9599.50	860.32	376.47
2851.93	73855.23	878.21	27710.49

FLOW

@ 7700 FT

DS FROM

BEAVER

RUN DAM

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY

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PMF

0.3 PMF

0.4 PMF

0.5 PMF

TOTAL VOLUME  
755952.  
21406.  
9.04  
229.70  
20825.  
25687.

72-HOUR  
3494.  
99.  
9.03  
229.35  
20794.  
25649.

24-HOUR  
5499.  
156.  
4.74  
120.32  
10908.  
13455.

6-HOUR  
6202.  
176.  
1.34  
33.92  
3076.  
3794.

PEAK  
6264.  
177.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 376.

858.1

MAXIMUM STAGE IS

TOTAL VOLUME  
428777.  
12142.  
5.13  
130.29  
11812.  
14570.

72-HOUR  
1984.  
56.  
5.13  
130.19  
11803.  
14559.

24-HOUR  
3126.  
89.  
2.69  
68.38  
6200.  
7647.

6-HOUR  
3137.  
89.  
.68  
17.16  
1555.  
1918.

PEAK  
3137.  
89.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 188.

855.2

MAXIMUM STAGE IS

TOTAL VOLUME  
503855.  
14768.  
6.03  
153.10  
13880.  
17121.

72-HOUR  
2331.  
66.  
6.02  
152.97  
13869.  
17107.

24-HOUR  
3200.  
91.  
2.76  
70.01  
6348.  
7830.

6-HOUR  
3212.  
91.  
.69  
17.57  
1593.  
1964.

PEAK  
3213.  
91.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 193.

855.3

MAXIMUM STAGE IS

TOTAL VOLUME  
524440.  
14850.  
6.27  
159.35  
14447.  
17821.

72-HOUR  
2425.  
69.  
6.27  
159.19  
14433.  
17802.

24-HOUR  
3266.  
92.  
2.81  
71.46  
6479.  
7992.

6-HOUR  
3276.  
93.  
.71  
17.92  
1624.  
2003.

PEAK  
3276.  
93.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 197.

855.3

MAXIMUM STAGE IS

FLOWS

@ 27700 FT

DS FROM  
BEAVER RUN  
DAM

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

BY

WJV

DATE

7-2-79

PROJ. NO.

78-617-453

CHKD. BY

DLB

DATE

7-2-79

SHEET NO.

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## SUB-AREA RUNOFF COMPUTATION

## LOCAL INFLOW INTO GILKERSON DAM RESERVOIR

ISTAO	ICUMP	IECON	ITAPE	JPL1	JPRT	INAME	ISTAGE	IAUTO
4	0	0	0	0	0	1	0	0

## HYDROGRAPH DATA

INYDG	IUNG	TAREA	SNAP	TRNSDA	TRNSPC	RATIO	ISNUM	ISAME	LOCAL
1	1	.33	0.00	54.40	0.00	0.000	0	1	0

## PRECIP DATA

SPFE	PMS	R6	R12	R24	R48	R72	R96
0.00	24.00	85.00	103.00	113.00	124.00	0.00	0.00

TRNSPC COMPUTED BY THE PROGRAM IS .652

## LOSS DATA

LROPT	STRAH	DLINK	RTIOL	ERAIN	STIRS	RTIOK	STKTL	CMSTL	ALSMX	RTIMP
0	0.00	0.00	1.00	0.00	0.00	1.00	1.00	.05	0.00	0.00

## UNIT HYDROGRAPH DATA

TP= 1.14 CP= .45 NTA= 0

## RECESSION DATA

SRTG= -1.50 ORCSN= -.05 RTIOR= 2.00  
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND IP ARE TC= 3.55 AND R= 5.46 INTERVALS

HAIF HYDROGRAPH 31 END-OF-PERIOD ORIGINATES, LAG= 1.15 HOURS, CP=.45 VOL= 1.00											
HR	PERIOD	RAIN	EXCS	LOSS	END-OF-PERIOD FLOW COMP 0	HR.MN	PERIOD	RAIN	EXCS	LOSS	COMP 0
1.	41.	72.	82.	73.	60.	50.	42.	35.	29.		
2.	20.	17.	14.	12.	10.	8.	7.	6.	5.		
3.	3.	2.	2.	2.	2.	1.	1.	1.	1.		
4.											
5.	1.										
SUM 25.35 22.87 2.48 14921.											
( 644.)( 581.)( 63.)( 422.52)											

## END-OF-PERIOD FLOW

MO.DA	HR.MM	PERIOD	RAIN	EXCS	LOSS	COMP U	MO.DA	HR.MM	PERIOD	RAIN	EXCS	LOSS	COMP U
SUM	25.35	22.87	2.48	14921.	( 644. )	( 581. )	( 63. )	( 422.52 )					

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
785.	517.	193.	69.	14931.
22.	15.	5.	2.	423.
	14.59	21.78	23.38	23.38
	370.50	553.22	593.73	593.90
	257.	383.	411.	411.
	317.	473.	507.	507.

LOCAL INFLOWS

INTO

GILKERSON

DAM RESERVOIR

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
236.	155.	58.	21.	4479.
7.	4.	2.	1.	127.
	4.38	6.53	7.01	7.01
	111.15	165.97	178.12	178.17
	77.	115.	123.	123.
	95.	142.	152.	152.

0.3 PMF

PMF



SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY

DLB

DATE

7-2-79

SHEET NO.

J

OF

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Engineers • Geologists • Planner  
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PEAK OUTFLOW IS 782. AT TIME 40.67 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
782.	514.	193.	69.	14936.
22.	15.	5.	2.	423.
	14.50	21.77	23.38	23.39
	368.25	553.06	593.87	594.11
	255.	383.	411.	411.
	315.	472.	507.	508.

PMF

PEAK OUTFLOW IS 220. AT TIME 41.33 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
220.	154.	58.	21.	4483.
6.	4.	2.	1.	127.
	4.34	6.51	7.02	7.02
	110.13	165.45	178.24	178.31
	76.	115.	123.	123.
	94.	141.	152.	152.

0.3 PMF

PEAK OUTFLOW IS 297. AT TIME 41.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
297.	205.	77.	28.	5976.
8.	6.	2.	1.	169.
	5.79	8.69	9.35	9.36
	147.13	220.72	237.59	237.69
	102.	153.	165.	165.
	126.	189.	203.	203.

0.4 PMF

PEAK OUTFLOW IS 373. AT TIME 41.00 HOURS

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
373.	257.	96.	35.	7469.
11.	7.	3.	1.	211.
	7.24	10.87	11.69	11.70
	183.94	276.06	296.97	297.10
	127.	191.	206.	206.
	157.	236.	254.	254.

0.5 PMF

GILKERSON

DAM

OUTFLOW

HYDROGRAPHS

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAMBY WJVDATE 7-2-79PROJ. NO. 78-617-453CHKD. BY DLBDATE 7-2-79SHEET NO. K OF EEEngineers • Geologists • Planner  
Environmental Specialists

PMF

## HYDROGRAPH ROUTING

ROUTE FROM GILKERSON DAM TO SECTION 5 + 1400 FT DS FROM GILKERSON DAM

ISIAU	ICOMP	IECON	ITAPE	JPLT	JPRF	INAME	ISTAGE	IAUTO
405	1	0	0	0	0	1	0	0
ROUTING DATA								
ULOSS	CLUSS	AVG	IRF	ISAME	IUPT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSTP'S								
1	0	0	0.000	0.000	X	TSK	STORA	ISPRAT
						0.000	-1.	0

## NORMAL DEPTH CHANNEL ROUTING

UN(1)	UN(2)	UN(3)	ELNVT	ELMAX	RLNTH	SEL
.1100	.0400	.1100	846.0	880.0	1400.	.12000

## CRUSS SECTION COORDINATES--STA,ELEV,STA,ELEV--ETC

	0.00	880.00	50.00	860.00	100.00	850.00	105.00	846.00	110.00	846.00
STORAGE	0.00	38.98	46.98	55.39	64.22	73.46	83.11	93.17	103.64	114.53
OUTFLOW	0.00	36306.29	46069.29	56964.14	68994.62	82169.10	96499.13	111998.59	128683.00	146569.12
STAGE	846.00	863.89	877.79	885.68	893.57	901.46	909.35	917.24	925.13	933.02
FLOW	0.00	36306.29	46069.29	56964.14	68994.62	82169.10	96499.13	111998.59	128683.00	146569.12

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
788.	514.	193.	69.	14936.
22.	15.	5.	2.	423.
	14.50	21.77	23.38	23.39
	368.31	553.06	591.87	594.11
	455.	383.	411.	411.
	315.	472.	507.	508.

FLOW  
@ 1400 FT  
DS FROM  
GILKERSON  
DAM

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 849.7

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 7-2-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 7-2-79 SHEET NO. L OF EE



Engineers • Geologists • Planner  
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PEAK 220. 6. 154. 4. 110.14 76. 94. 24-HOUR 58. 2. 6.51 165.45 115. 141. 72-HOUR 21. 1. 7.02 178.31 123. 152. TOTAL VOLUME 4483. 127. 7.07 178.31 123. 152.

MAXIMUM STORAGE = 0.

MAXIMUM STAGE IS 847.9

PEAK 298. 8. 206. 6. 147.15 102. 126. 24-HOUR 77. 2. 8.69 220.71 153. 189. 72-HOUR 28. 1. 9.35 237.69 165. 203. TOTAL VOLUME 5976. 169. 9.36 237.69 165. 203.

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 848.2

PEAK 373. 11. 257. 7. 183.97 127. 157. 24-HOUR 96. 3. 10.87 276.06 191. 236. 72-HOUR 35. 1. 11.69 296.97 206. 254. TOTAL VOLUME 7469. 211. 11.70 297.10 206. 254.

MAXIMUM STORAGE = 1.

MAXIMUM STAGE IS 848.4

SUB-AREA RUNOFF COMPUTATION

LOCAL INFLOW INTO BEAVER DAM RESERVOIR

INFL	INFL	TAKEA	SNAP	TRSDA	TRSPC	RATIO	ISNUM	ISAME	ISTAGE	IAUTO
1	1	10.90	0.00	54.40	0.00	0.000	0	1	0	0
1	1	10.90	0.00	54.40	0.00	0.000	0	1	0	0

HYDROGRAPH DATA

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAMBY WJVDATE 7-2-79PROJ. NO. 78-617-453CHKD. BY DLBDATE 7-2-79SHEET NO. M OF EEEngineers • Geologists • Planner  
Environmental Specialists

PRECIP DATA  
R6 R12 R24 R48 R72 R96  
0.00 24.00 85.00 103.00 113.00 124.00 0.00 0.00 0.00  
TRNSPC COMPUTED BY THE PROGRAM IS .852

LOSS DATA  
LROPT STRR ULTR RTIOL ERAIN STRKS RTIOK STRTL CMSTL ALSMX RTIMP  
0 0.00 0.00 1.00 0.00 0.00 1.00 1.00 1.00 .05 0.00 0.00

UNIT HYDROGRAPH DATA  
TP= 4.46 CP= .45 NTA= 0

RECESSION DATA  
STRTU= -1.50 ORCSN= -.05 RTION= 2.00  
APPROXIMATE CLARK COEFFICIENTS FROM GIVEN SNYDER CP AND TP ARE TC=14.05 AND R=21.29 INTERVALS

UNIT HYDROGRAPH 100 END-OF-PERIOD ORIGINATES, LAG= 4.50 HOURS, CP= .45 VOL= .99

13.	49.	101.	164.	234.	310.	392.	473.	547.	610.
660.	697.	721.	726.	706.	674.	643.	614.	585.	559.
533.	508.	485.	463.	442.	421.	402.	384.	366.	349.
333.	318.	303.	289.	276.	263.	251.	240.	229.	218.
208.	199.	190.	181.	173.	165.	157.	150.	143.	136.
130.	124.	119.	113.	108.	103.	98.	94.	89.	85.
81.	78.	74.	71.	67.	64.	61.	59.	56.	53.
51.	49.	46.	44.	42.	40.	38.	37.	35.	33.
32.	30.	29.	28.	26.	25.	24.	23.	22.	21.
20.	19.	18.	17.	16.	16.	15.	14.	14.	13.

END-OF-PERIOD FLOW  
MU.DA HR.MM PERIOD MAIN EXCS LOSS COMP 0  
SUM 25.35 22.87 2.48 478576.  
( 644. )( 581. )( 63. )( 13551.76 )

LOCAL INFLOWS INTO BEAVER DAM RESERVOIR

CFS	CMS	INCHES	MM	AC-FT	THOUS CU M
PEAK 11933.	3580.	101.	2580.	338.	6455.
6-HOUR 10554.	3166.	90.	228.77	5233.	6455.
24-HOUR 5745.	1724.	49.	14056.	11395.	14056.
72-HOUR 2214.	664.	19.	16251.	13175.	16251.
TOTAL VOLUME 478572.	143572.	4065.	576.33	13184.	16262.

0.3 PMF

CFS	CMS	INCHES	MM	AC-FT	THOUS CU M
PEAK 3580.	101.	2580.	338.	6455.	14056.
6-HOUR 3166.	90.	228.77	5233.	13175.	16251.
24-HOUR 1724.	49.	14056.	11395.	13175.	16251.
72-HOUR 664.	19.	16251.	13175.	13175.	16251.
TOTAL VOLUME 143572.	4065.	576.33	13184.	16262.	16262.

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

BY WJV

DATE 7-2-79

PROJ. NO. 78-617-453

CHKD. BY DLB

DATE 7-2-79

SHEET NO. N OF EE

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COMBINE LOCAL BEAVER DAM INFLOW #7 ROUTED GILKERSON DAM OUTFLOW									
PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	IAUTO	0	0	0	0
4773.	4222.	2298.	886.	191429.	0.4 PMF				
135.	120.	65.	25.	5421.					
	3.60	7.84	9.07	9.08					
	91.51	199.26	230.38	230.53					
	2093.	4558.	5270.	5274.					
	2582.	5622.	6500.	6505.					
PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	0.5 PMF				
5966.	5277.	2873.	1107.	239286.					
169.	149.	81.	31.	6776.					
	4.50	9.81	11.34	11.35					
	114.39	249.08	287.97	288.17					
	2617.	5698.	6587.	6592.					
	3228.	7028.	8125.	8131.					

## COMBINE HYDROGRAPHS

COMBINE LOCAL BEAVER DAM INFLOW #7 ROUTED GILKERSON DAM OUTFLOW

PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	PMF				
12275.	10884.	5926.	2283.	493508.					
348.	308.	168.	65.	13975.					
	9.02	19.64	22.70	22.71					
	228.99	498.74	576.47	576.86					
	5397.	11754.	13586.	13595.					
	6657.	14499.	16758.	16770.					
PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	0.3 PMF				
3686.	3271.	1778.	685.	148054.					
104.	93.	50.	19.	4192.					
	2.71	5.89	6.81	6.81					
	68.82	149.68	172.94	173.06					
	1622.	3528.	4076.	4079.					
	2001.	4351.	5028.	5031.					
PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	0.4 PMF				
4915.	4360.	2371.	913.	197404.					
139.	123.	67.	26.	5590.					
	3.61	7.86	9.08	9.08					
	91.73	199.55	230.59	230.74					
	2162.	4703.	5434.	5438.					
	2667.	5801.	6703.	6708.					
PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME	0.5 PMF				
6145.	5449.	2964.	1142.	246755.					
174.	154.	84.	32.	6987.					
	4.51	9.82	11.35	11.36					
	114.64	249.42	288.23	288.43					
	2702.	5878.	6793.	6798.					
	3333.	7251.	8379.	8385.					

COMBINED  
ROUTED GILKERSON  
OUTFLOWS + LOCAL  
BEAVER DAM RESERVOIR  
INFLOWS

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAM

BY WJV

DATE

7-2-79

PROJ. NO.

78-617-453

CHKD. BY DLB

DATE

7-2-79

SHEET NO.

0

OF EE

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## COMBINE HYDROGRAPHS

COMBINE ROUTED BEAVER RUN DAM OUTFLOW W/ PREVIOUS COMBINED FLOWS

ISTAO	ICUMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
6	2	0	0	0	0	1	0	0
PEAK								
15379.		13947.	9518.	72-HOUR	5724.	TOTAL VOLUME		
435.		395.	270.		162.	1249460.		
						35381.		
INCHES						11.74		
2.38		6.51				11.86		
MM		60.54	165.27			301.33		
AC-FT		6916.	18879.			34820.		
THOUS CU M		8531.	23286.			42457.		
PEAK								
5191.		5011.	4194.	72-HOUR	2653.	TOTAL VOLUME		
147.		142.	119.		75.	576831.		
						16334.		
INCHES						5.48		
.86		21.75	72.83			139.11		
MM		2485.	8319.			15891.		
AC-FT		3065.	10262.			19601.		
THOUS CU M								
PEAK								
6820.		6473.	4926.	72-HOUR	3223.	TOTAL VOLUME		
193.		183.	139.		91.	701260.		
						19857.		
INCHES						6.66		
1.11		28.10	85.53			169.12		
MM		3210.	9771.			19318.		
AC-FT		3959.	12052.			23829.		
THOUS CU M								
PEAK								
8455.		7838.	5620.	72-HOUR	3540.	TOTAL VOLUME		
239.		222.	159.		100.	771195.		
						21838.		
INCHES						7.32		
1.34		34.02	97.59			185.99		
MM		3887.	11147.			21245.		
AC-FT		4794.	13750.			26205.		
THOUS CU M								

TOTAL INFLOW  
HYDROGRAPHS  
INTO  
BEAVER DAM  
RESERVOIR

## HYDROGRAPH ROUTING

ROUTE TOTAL COMBINED HYDROGRAPH THROUGH BEAVER DAM RESERVOIR

ISTAO	ICUMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTO
606	1	0	0	0	0	1	0	0
QLOSS								
0.0								
AVG								
0.00								
NSIPS								
1								
LAG								
0								
AMSKK								
X								
0.000								
IPMP								
0								
IPSPAT								
18.								
ISPRAT								
1								

# DAM SAFETY INSPECTION

## BEAVER DAM

BY WJV

DATE 7-2-79

PROJ. NO. 79-617-453

CHKD. BY DLB

DATE 7-2-79

SHEET NO. 9 OF EE



**Engineers • Geologists • Planner  
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CAPACITY=	0.	12.	18.	31.	45.	61.	79.	98.	119.	148.
	178.	232.	293.	360.	433.	512.	597.	689.	788.	
ELEVATION=	842.	843.	844.	845.	846.	847.	848.	849.	850.	851.
	852.	854.	856.	859.	860.	862.	864.	866.	868.	

CKEL	SPWID	COUW	EXPM	ELEV	CUOL	CAREA	EXPL
843.5	100.0	0.0	0.0	0.0	0.0	0.0	0.0

[illegible][illegible]

DEAN OUTLINE IS 15374. AT TIME 44.00 HOURS

BEAVER  
DAM  
OUTFLOW  
/PHOTOGRAPH

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CMS	15374.	13938.	9514.	5714.	1246544.
CMS	435.	395.	269.	162.	35298.
INCHES		2.30	6.50	11.72	11.84
MM		60.51	165.20	297.65	300.62
AC-FT		6912.	18871.	34000.	34340.
THOUS CU M		8525.	23277.	41938.	42358.

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAMBY WJVDATE 7-2-79PROJ. NO. 79-617-453CHKD. BY DLBDATE 7-2-79SHEET NO. Q OF EEEngineers • Geologists • Planners  
Environmental Specialists

0.3 PMF

PEAK 5183.  
147.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

6-HOUR 5010.  
142.  
.86  
21.75  
2484.  
3064.

24-HOUR 4193.  
119.  
2.87  
72.81  
9317.  
10259.

72-HOUR 2648.  
75.  
5.43  
137.92  
15755.  
19433.

TOTAL VOLUME  
575519.  
16297.  
5.46  
138.80  
15855.  
19556.

0.4 PMF

PEAK 6807.  
193.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

6-HOUR 6469.  
183.  
1.11  
28.08  
3208.  
3956.

24-HOUR 4925.  
139.  
3.37  
85.52  
9769.  
12050.

72-HOUR 3212.  
91.  
6.59  
167.31  
19112.  
23574.

TOTAL VOLUME  
698596.  
19782.  
6.63  
168.48  
19245.  
23738.

0.5 PMF

PEAK 8435.  
239.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

6-HOUR 7828.  
222.  
1.34  
33.98  
3882.  
4788.

24-HOUR 5618.  
159.  
3.84  
97.55  
11143.  
13745.

72-HOUR 3530.  
100.  
7.24  
183.87  
21004.  
25908.

TOTAL VOLUME  
768477.  
21761.  
7.30  
185.33  
21170.  
26113.

PEAK OUTFLOW IS 5183. AT TIME 48.67 HOURS

PEAK OUTFLOW IS 6807. AT TIME 46.33 HOURS

PEAK OUTFLOW IS 8435. AT TIME 45.33 HOURS

BEAVER DAM

OUTFLOW

HYDROGRAPHS

OVERTOPPING

OCCURS @

20.36 PMF

## HYDROGRAPH ROUTING

ROUTE FROM BEAVER DAM TO SECTION 7 + 1200 FT DS FROM BEAVER DAM

ISTAU	ICUMP	IECON	ITAPE	JPLT	JPRT	INAME	ISTAGE	IAUTU
607	1	0	0	0	0	1	0	0
ROUTING DATA								
GLUSS	CLUSS	AVG	IRIS	ISAME	IOFT	IPMP	LSTR	
0.0	0.000	0.00	1	1	0	0	0	
NSIPS	MSIDL	LAG	AMSKK	X	TSK	STURA	ISPRAT	
1	0	0	0.000	0.000	0.000	-1.	0	

NORMAL DEPTH CHANNEL ROUTING

UN(1) UN(2) UN(3) ELHVT ELMAX RLNTH SEL

.0600 .0400 .1000 804.0 840.0 1200. .01400

SUBJECT

DAM SAFETY INSPECTION  
BEAVER DAMBY WJVDATE 7-2-79PROJ. NO. 78-617-453CHKD. BY DLBDATE 7-2-79SHEET NO. R OF EEEngineers • Geologists • Planners  
Environmental Specialists

## CROSS SECTION COORDINATES--STA, ELEV, STA, ELEV--ETC

	0.00	1.68	3.70	6.93	11.61	18.55	28.04	40.06	54.63
	89.05	107.29	126.14	145.61	165.70	186.40	207.73	229.67	252.23
STORAGE									
OUTFLOW	0.00	383.26	1256.17	2654.61	4705.07	7655.80	11635.48	16813.20	23341.51
	42258.11	54027.51	67136.10	81555.97	97268.15	114259.85	132522.83	152052.37	172846.47
STAGE	804.00	805.89	807.79	809.68	811.58	813.47	815.37	817.26	819.16
	822.95	824.84	826.74	828.63	830.53	832.42	834.32	836.21	838.11
FLOW	0.00	383.26	1256.17	2654.61	4705.07	7655.80	11635.48	16813.20	23341.51
	42258.11	54027.51	67136.10	81555.97	97268.15	114259.85	132522.83	152052.37	172846.47

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	15372.	13936.	9514.	5713.	1246226.
CMS	435.	395.	269.	162.	35289.
INCHES		2.38	6.50	11.72	11.83
MM		60.50	165.21	297.59	300.55
AC-FT		6910.	18872.	33993.	34331.
THOUS CU M		8524.	23278.	41930.	42347.

PMF

MAXIMUM STORAGE = 37.

0.3 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	5184.	5010.	4193.	2647.	575301.
CMS	147.	142.	119.	75.	16293.
INCHES		.86	2.87	5.43	5.46
MM		21.75	72.81	137.90	138.76
AC-FT		2484.	8317.	15752.	15851.
THOUS CU M		3064.	10259.	19429.	19552.

0.4 PMF

	PEAK	6-HOUR	24-HOUR	72-HOUR	TOTAL VOLUME
CFS	6808.	6468.	4925.	3211.	698309.
CMS	193.	183.	139.	91.	19774.
INCHES		1.11	3.37	6.58	6.63
MM		28.08	85.52	167.25	168.41
AC-FT		3207.	9769.	19105.	19237.
THOUS CU M		3956.	12049.	23566.	23729.

MAXIMUM STORAGE = 13.

MAXIMUM STORAGE = 17.

FLOWS

@ 1200 FT

DS FROM

BEAVER DAM

@ 1st

HOUSE

MAXIMUM STAGE IS 816.7

MAXIMUM STAGE IS 811.9

MAXIMUM STAGE IS 812.9



SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

Y WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY DLB

DATE

7-2-79

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PMF

0.3 PMF

0.4 PMF

0.5 PMF

TOTAL VOLUME  
1246101.  
35286.  
11.83  
300.52  
34328.  
42343.

72-HOUR  
5712.  
162.  
11.72  
297.57  
33991.  
41927.

24-HOUR  
9515.  
269.  
6.50  
165.21  
18872.  
23278.

6-HOUR  
13934.  
395.  
2.38  
60.49  
6909.  
8523.

PEAK  
15364.  
435.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 16.

819.4

MAXIMUM STAGE IS

TOTAL VOLUME  
575317.  
16291.  
5.46  
138.75  
15849.  
19549.

72-HOUR  
2647.  
75.  
5.43  
137.88  
15750.  
19428.

24-HOUR  
4193.  
119.  
2.87  
72.81  
8317.  
10259.

6-HOUR  
5009.  
142.  
.86  
21.75  
2484.  
3064.

PEAK  
5184.  
147.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 5.

807.8

MAXIMUM STAGE IS

TOTAL VOLUME  
698193.  
19771.  
6.63  
168.38  
19234.  
23725.

72-HOUR  
3210.  
91.  
6.58  
167.23  
19102.  
23562.

24-HOUR  
4925.  
139.  
3.37  
85.52  
9769.  
12049.

6-HOUR  
6468.  
183.  
1.11  
28.08  
3207.  
3956.

PEAK  
6809.  
193.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 6.

810.3

MAXIMUM STAGE IS

TOTAL VOLUME  
768065.  
21749.  
7.29  
185.23  
21159.  
26099.

72-HOUR  
3528.  
100.  
7.24  
183.79  
20994.  
25896.

24-HOUR  
5618.  
159.  
3.84  
97.55  
11143.  
13745.

6-HOUR  
7829.  
222.  
1.34  
33.99  
3882.  
4789.

PEAK  
8437.  
239.

CFS  
CMS  
INCHES  
MM  
AC-FT  
THOUS CU M

MAXIMUM STORAGE = 7.

812.8

MAXIMUM STAGE IS

FLOWS

@ 1800 FT

DS FROM

BEAVER DAM

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM

✓ WJV

DATE. 7-2-79

PROJ. NO. 73-617-453

CHKD. BY DLB

DATE 7-2-79

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## SUMMARY OF DAM SAFETY ANALYSIS

BEAVER RUN DAM

RAVITD OF PNE	ELEVATION STORAGE OUTFLOW	INITIAL VALUE 1050.00 34000. 0.	SPILLWAY CHEST 1050.00 34000. 0.	TOP OF DAM 1070.00 64000. 3460.	DURATION OVER TOP HOURS	MAXIMUM OUTFLOW CFS	MAXIMUM STORAGE AC-FT	MAXIMUM DEPTH OVER DAM	MAXIMUM RESERVOIR W.S.ELEV	RAVITD OF PNE	TIME OF	
											MAX OUTFLOW HOURS	FAILURE HOURS
.20	1054.09				0.00	2834.	39721.	0.00		.20	56.67	0.00
.30	1056.44				0.00	3136.	43029.	0.00		.30	59.67	0.00
.40	1059.34				0.00	3213.	47070.	0.00		.40	62.00	0.00
.50	1062.11				0.00	3276.	51372.	0.00		.50	64.00	0.00
1.00	1074.04				42.67	6281.	72072.	4.04		1.00	64.33	0.00

PLAN 1 STATION 2

PLAN	1	STATION	3
------	---	---------	---

RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
.20	2831.	978.2	57.00	.20	2825.	854.8	58.00
.30	3137.	978.7	60.00	.30	3137.	855.2	60.67
.40	3213.	978.8	62.67	.40	3213.	855.3	63.33
.50	3276.	978.9	64.33	.50	3276.	855.3	65.33
1.00	6276.	982.8	64.67	1.00	6264.	858.1	65.67

## SUMMARY OF DAM SAFETY ANALYSIS

GILKERSON DAM

RATIO OF PAF	ELEVATION STORAGE OUTFLOW	INITIAL VALUE		SPILLWAY CREST		TUP OF DAM		TIME OF FAILURE HOURS
		1023.00 30. 0.	1023.00 30. 0.	1023.00 30. 0.	1027.00 50. 520.			
	MAXIMUM RESERVOIR W.S.ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS		
.20	1024.91	0.00	38.	147.	0.00	41.00		0.00
.30	1025.43	0.00	41.	220.	0.00	41.33		0.00
.40	1025.87	0.00	43.	297.	0.00	41.00		0.00
.50	1026.27	0.00	45.	373.	0.00	41.00		0.00
1.00	1027.31	.31	52.	782.	2.67	40.67		0.00

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
WJV DATE 7-2-79 PROJ. NO. 79-617-453  
 CHKD. BY DLB DATE 7-2-79 SHEET NO. V OF EE

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PLAN 1 STATION 5

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.20	147.	847.4	41.33
.30	220.	847.9	41.33
.40	298.	848.2	41.00
.50	373.	848.4	41.00
1.00	788.	849.7	40.67

SUMMARY OF DAM SAFETY ANALYSIS

BEAVER DAM

ELEVATION STORAGE OUTFLOW	INITIAL VALUE	SPILLWAY CREST	TOP OF DAM
	843.50	843.50	850.80
	18.	18.	148.
	0.	0.	6003.

RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
.20	848.47	0.00	97.	3396.	0.00	53.00	0.00
.30	850.10	0.00	132.	5183.	0.00	48.67	0.00
.40	851.42	.62	164.	6807.	5.67	46.33	0.00
.50	852.55	1.75	193.	8435.	9.00	45.33	0.00
1.00	855.43	4.63	276.	15374.	32.00	44.00	0.00

PLAN 1 STATION 7

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.20	3396.	810.4	53.00
.30	5184.	811.9	48.67
.40	6808.	812.9	46.33
.50	8437.	813.8	45.33
1.00	15372.	816.7	44.00

PLAN 1 STATION 8

RATIO	MAXIMUM FLOW, CFS	MAXIMUM STAGE, FT	TIME HOURS
.20	3396.	804.7	53.00
.30	5184.	807.8	48.67
.40	6809.	810.3	46.33
.50	8437.	812.8	45.33
1.00	15364.	819.4	44.00

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

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PROJ. NO.

78-617-453

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BREACHING OF BEAVER  
DAM ONLY, STAGE BOTH  
BEAVER RUN AND GILKERSON  
DAMS WILL NOT BE  
OVERTOPPED BY THE  
0.38 PMF EVENT. (SAME  
INPUT DATA AS FOR THE  
OVERTOPPING ANALYSIS  
W/ THE ADDITION OF THE  
BREACH DATA GIVEN HERE)

## BREACHING ANALYSIS

### BREACHING ANALYSIS \*\*\*

DAM SAFETY INSPECTION  
BEAVER DAM W/ US HEAVEN RUN DAM AND GILKERSON DAM \*\*\*  
20-MINUTE TIME STEP AND 46-HOUR STORM DURATION

JOB SPECIFICATION  
IDAY 0 IHR 0 IMIN 0 METC 0 NSTAN 0  
JUPER 5 HWT 0 LRUPT 0 TRACE 0

MULTI-PLAN ANALYSES TO BE PERFORMED  
NPLAN= 5 NRTIUE= 1 LRTIUE= 1

NRTIUE= .38

### HYDROGRAPH ROUTING

ROUTE TOTAL COMBINED HYDROGRAPH THROUGH BEAVER DAM RESERVOIR

### PLAN

CREST LENGTH AT OR BELOW ELEVATION	DAM DATA		TUPEL 850.8	CUUD 0.0	EXPD 0.0	DAMWID 0.
	BRWID	ELBM				
0.	20.	45.	95.	180.	225.	250.
850.8	851.3	853.0	853.2	853.5	853.6	854.5

DAM BREACH DATA		WSEL	TFAIL	WSEL	TFAIL
BRWID	ELBM				
0.	842.80	1.00	843.50	850.80	850.80
2	842.80	1.00	843.50	850.80	850.80

BEGIN DAM FAILURE AT 44.33 HOURS

PEAK OUTFLOW IS 6471. AT TIME 46.67 HOURS

DAM BREACH DATA		WSEL	TFAIL	WSEL	TFAIL
BRWID	ELBM				
200.	842.80	1.00	843.50	850.80	850.80
2	842.80	1.00	843.50	850.80	850.80

BEGIN DAM FAILURE AT 44.33 HOURS

PEAK OUTFLOW IS 7558. AT TIME 45.33 HOURS

DAM BREACH DATA		WSEL	TFAIL	WSEL	TFAIL
BRWID	ELBM				
0.	842.80	4.00	843.50	850.80	850.80
2	842.80	4.00	843.50	850.80	850.80

BEGIN DAM FAILURE AT 43.33 HOURS

PEAK OUTFLOW IS 6493. AT TIME 46.50 HOURS

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

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PLAN

DAM BREACH DATA

HRWD	Z	ELDM	TFAIL	WSEL	FAILED
200.	2.00	842.80	4.00	843.50	850.80

BEGIN DAM FAILURE AT 44.33 HOURS

PEAK OUTFLOW IS 6777. AT TIME 46.42 HOURS

(4)

DAM BREACH DATA

HRWD	Z	ELDM	TFAIL	WSEL	FAILED
100.	1.00	842.80	2.00	843.50	850.80

BEGIN DAM FAILURE AT 44.33 HOURS

PEAK OUTFLOW IS 6774. AT TIME 46.33 HOURS

(5)

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION. DOWNSREAM CALCULATIONS WILL USE A TIME INTERVAL OF .333 HOURS. THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH. INTERMEDIATE FLOODS ARE INTERPOLATED FROM END-OF-PERIOD VALUES.

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	COMPUTED BREACH HYDROGRAPH (CFS)	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
44.333	0.000	6065.	6065.	0.	0.	0.
44.375	.042	6110.	6105.	5.	5.	0.
44.417	.083	6156.	6154.	2.	7.	0.
44.458	.125	6201.	6204.	-4.	4.	0.
44.500	.167	6246.	6254.	-8.	-5.	-0.
44.542	.208	6291.	6302.	-11.	-16.	-0.
44.583	.250	6336.	6347.	-11.	-27.	-0.
44.625	.292	6381.	6389.	-8.	-35.	-0.
44.667	.333	6427.	6427.	0.	-35.	-0.
44.708	.375	6453.	6461.	-8.	-43.	-0.
44.750	.417	6479.	6492.	-13.	-56.	-0.
44.792	.458	6505.	6521.	-16.	-72.	-0.
44.833	.500	6531.	6547.	-16.	-89.	-0.
44.875	.542	6557.	6572.	-15.	-103.	-0.
44.917	.583	6583.	6594.	-11.	-114.	-0.
44.958	.625	6609.	6615.	-6.	-120.	-0.
45.000	.667	6635.	6635.	0.	-120.	-0.

(5)

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

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LINE (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	COMPUTED BREACH HYDROGRAPH (CFS)	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
45.042	.708	6651.	6654.	-3.	-123.	0.
45.083	.750	6668.	6672.	-4.	-127.	0.
45.125	.792	6684.	6689.	-5.	-132.	0.
45.167	.833	6700.	6705.	-5.	-137.	0.
45.208	.875	6716.	6721.	-5.	-142.	0.
45.250	.917	6732.	6736.	-4.	-145.	0.
45.292	.958	6749.	6751.	-2.	-147.	-1.
45.333	1.000	6765.	6765.	0.	-147.	-1.
45.375	1.042	6778.	6779.	-1.	-148.	-1.
45.417	1.083	6791.	6792.	-1.	-150.	-1.
45.458	1.125	6803.	6806.	-3.	-152.	-1.
45.500	1.167	6816.	6819.	-3.	-155.	-1.
45.542	1.208	6829.	6831.	-2.	-157.	-1.
45.583	1.250	6842.	6844.	-2.	-159.	-1.
45.625	1.292	6855.	6856.	-1.	-161.	-1.
45.667	1.333	6868.	6868.	0.	-161.	-1.
45.708	1.375	6877.	6879.	-2.	-162.	-1.
45.750	1.417	6887.	6889.	-2.	-163.	-1.
45.792	1.458	6897.	6899.	-2.	-165.	-1.
45.833	1.500	6907.	6909.	-2.	-167.	-1.
45.875	1.542	6917.	6919.	-2.	-169.	-1.
45.917	1.583	6927.	6928.	-1.	-170.	-1.
45.958	1.625	6937.	6938.	-1.	-171.	-1.
46.000	1.667	6947.	6947.	0.	-171.	-1.
46.042	1.708	6950.	6955.	-5.	-176.	-1.
46.083	1.750	6954.	6963.	-9.	-185.	-1.
46.125	1.792	6957.	6969.	-12.	-198.	-1.
46.167	1.833	6960.	6973.	-13.	-210.	-1.
46.208	1.875	6964.	6971.	-7.	-218.	-1.
46.250	1.917	6967.	6971.	-4.	-221.	-1.
46.292	1.958	6971.	6971.	-1.	-222.	-1.
46.333	2.000	6974.	6974.	0.	-222.	-1.

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

78-617-453

CHKD. BY

DLB

DATE

7-2-79

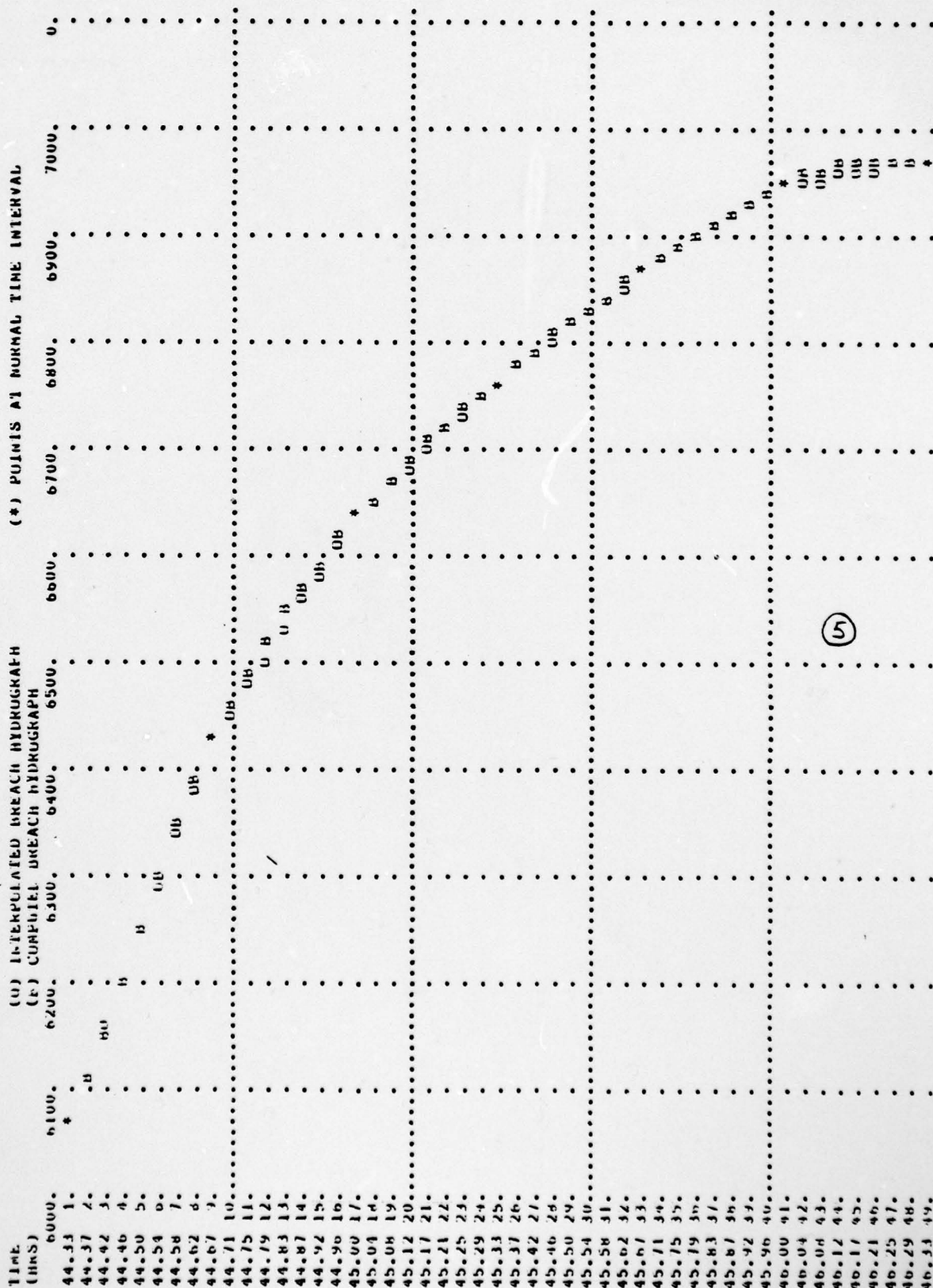
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SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
WJV DATE 7-2-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 7-2-79 SHEET NO. AA OF EE

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DAM BREACH DATA  
 Z ELBM TFAIL WSEL FALLEL  
 1.00 825.80 2.00 843.50 850.80

BEGIN DAM FAILURE AT 44.33 HOURS  
 PEAK OUTFLOW IS 7983. AT TIME 45.58 HOURS

PLAN (6)

THE DAM BREACH HYDROGRAPH WAS DEVELOPED USING A TIME INTERVAL OF .042 HOURS DURING BREACH FORMATION.  
 DOWNSTREAM CALCULATIONS WILL USE A TIME INTERVAL OF .333 HOURS.  
 THIS TABLE COMPARES THE HYDROGRAPH FOR DOWNSTREAM CALCULATIONS WITH THE COMPUTED BREACH HYDROGRAPH.  
 INTERMEDIATE FLOWS ARE INTERPOLATED FROM END-UP-PERIOD VALUES.

TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	COMPUTED BREACH HYDROGRAPH (CFS)	= ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
44.333	0.000	6065.	6065.	0.	0.	0.
44.375	.042	6226.	6198.	28.	28.	0.
44.417	.083	6387.	6386.	1.	30.	0.
44.458	.125	6548.	6585.	-37.	-7.	-0.
44.500	.167	6710.	6773.	-64.	-71.	-0.
44.542	.208	6871.	6946.	-75.	-146.	-1.
44.583	.250	7032.	7100.	-68.	-214.	-1.
44.625	.292	7193.	7236.	-43.	-257.	-1.
44.667	.333	7354.	7354.	0.	-257.	-1.
44.708	.375	7417.	7457.	-40.	-297.	-1.
44.750	.417	7480.	7546.	-66.	-363.	-1.
44.792	.458	7543.	7623.	-80.	-443.	-2.
44.833	.500	7606.	7687.	-81.	-524.	-2.
44.875	.542	7669.	7741.	-73.	-597.	-2.
44.917	.583	7732.	7790.	-58.	-655.	-2.
44.958	.625	7795.	7834.	-39.	-694.	-2.
45.000	.667	7858.	7858.	0.	-694.	-2.
45.042	.708	7869.	7870.	-1.	-695.	-2.
45.083	.750	7880.	7887.	-7.	-701.	-2.
45.125	.792	7892.	7905.	-14.	-715.	-2.
45.167	.833	7903.	7923.	-20.	-735.	-3.
45.208	.875	7914.	7942.	-28.	-763.	-3.
45.250	.917	7926.	7962.	-36.	-799.	-3.

(6)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM

WJV DATE 7-2-79 PROJ. NO. 79-617-453

CHKD. BY DLB DATE 7-2-79 SHEET NO. 88 OF EE



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TIME (HOURS)	TIME FROM BEGINNING OF BREACH (HOURS)	INTERPOLATED BREACH HYDROGRAPH (CFS)	COMPUTED BREACH HYDROGRAPH (CFS)	ERROR (CFS)	ACCUMULATED ERROR (CFS)	ACCUMULATED ERROR (AC-FT)
45.292	.958	7937.	7954.	-17.	-816.	-3.
45.333	1.000	7948.	7948.	0.	-816.	-3.
45.375	1.042	7933.	7951.	-18.	-833.	-3.
45.417	1.083	7918.	7927.	-10.	-843.	-3.
45.458	1.125	7903.	7915.	-12.	-855.	-3.
45.500	1.167	7887.	7923.	-35.	-890.	-3.
45.542	1.208	7872.	7957.	-85.	-976.	-3.
45.583	1.250	7857.	7983.	-126.	-1102.	-4.
45.625	1.292	7842.	7890.	-49.	-1150.	-4.
45.667	1.333	7827.	7827.	0.	-1150.	-4.
45.708	1.375	7822.	7795.	28.	-1123.	-4.
45.750	1.417	7818.	7780.	38.	-1084.	-4.
45.792	1.458	7813.	7774.	39.	-1045.	-4.
45.833	1.500	7809.	7774.	35.	-1010.	-3.
45.875	1.542	7804.	7776.	28.	-982.	-3.
45.917	1.583	7800.	7781.	20.	-962.	-3.
45.958	1.625	7796.	7786.	10.	-952.	-3.
46.000	1.667	7791.	7791.	0.	-952.	-3.
46.042	1.708	7794.	7796.	-2.	-954.	-3.
46.083	1.750	7797.	7800.	-3.	-957.	-3.
46.125	1.792	7800.	7803.	-3.	-960.	-3.
46.167	1.833	7803.	7805.	-3.	-963.	-3.
46.208	1.875	7806.	7808.	-2.	-965.	-3.
46.250	1.917	7808.	7810.	-1.	-966.	-3.
46.292	1.958	7811.	7812.	-1.	-967.	-3.
46.333	2.000	7814.	7814.	0.	-967.	-3.



SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY

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DATE

7-2-79

SHEET NO.

DD OF EE

Engineers • Geologists • Planners  
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## SUMMARY OF DAM SAFETY ANALYSIS

## BEAVER RUN DAM

INITIAL VALUE  
1050.00  
34000.  
0.

SPILLWAY CHEST  
1050.00  
34000.  
0.

TOP OF DAM  
1070.00  
64000.  
3460.

RATIO  
OF  
PAF  
.38

MAXIMUM  
RESERVOIR  
W.S.ELEV  
1058.74

MAXIMUM  
DEPTH  
OVER DAM  
0.00

MAXIMUM  
STORAGE  
AC-FT  
46236.

MAXIMUM  
OUTFLOW  
CFS  
3197.

DURATION  
OVER TOP  
HOURS  
0.00

TIME OF  
MAX OUTFLOW  
HOURS  
61.67

TIME OF  
FAILURE  
HOURS  
0.00

} FOR ALL  
PLANS

STATION 2

STATION 3

RATIO  
OF  
PAF  
.38

MAXIMUM  
FLOW, CFS  
3197.

MAXIMUM  
STAGE, FT  
978.8

TIME  
HOURS  
62.00

MAXIMUM  
FLOW, CFS  
3197.

MAXIMUM  
STAGE, FT  
855.3

TIME  
HOURS  
63.00

} FOR ALL  
PLANSROUTED  
BEAVER RUN  
DAM  
OUTFLOWS

## SUMMARY OF DAM SAFETY ANALYSIS

## GILKERSON DAM

INITIAL VALUE  
1023.00  
30.  
0.

SPILLWAY CHEST  
1023.00  
30.  
0.

TOP OF DAM  
1027.00  
50.  
520.

RATIO  
OF  
PAF  
.38

MAXIMUM  
RESERVOIR  
W.S.ELEV  
1025.79

MAXIMUM  
DEPTH  
OVER DAM  
0.00

MAXIMUM  
STORAGE  
AC-FT  
43.

MAXIMUM  
OUTFLOW  
CFS  
282.

DURATION  
OVER TOP  
HOURS  
0.00

TIME OF  
MAX OUTFLOW  
HOURS  
41.00

TIME OF  
FAILURE  
HOURS  
0.00

} FOR ALL  
PLANS

STATION 5

ROUTED  
GILKERSON  
DAM  
OUTFLOW

RATIO  
OF  
PAF  
.38

MAXIMUM  
FLOW, CFS  
282.

MAXIMUM  
STAGE, FT  
848.1

TIME  
HOURS  
41.00

} FOR ALL  
PLANS

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

WJV

DATE

7-2-79

PROJ. NO.

79-617-453

CHKD. BY

DLB

DATE

7-2-79

SHEET NO.

EE OF EE



Engineers • Geologists • Planner  
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## SUMMARY OF DAM SAFETY ANALYSIS

## BEAVER DAM

TOP OF DAM  
850.80  
148.  
6003.

SPILLWAY CREST  
843.50  
18.  
0.

INITIAL VALUE  
843.50  
18.  
0.

ELEVATION  
STORAGE  
OUTFLOW

PLAN	RATIO OF PMF	MAXIMUM RESERVOIR W.S. ELEV	MAXIMUM DEPTH OVER DAM	MAXIMUM STORAGE AC-FT	MAXIMUM OUTFLOW CFS	DURATION OVER TOP HOURS	TIME OF MAX OUTFLOW HOURS	TIME OF FAILURE HOURS
1	.38	850.98	.18	153.	6471.	3.67	46.67	44.33
2	.38	850.85	.05	149.	7558.	.43	45.33	44.33
3	.38	851.13	.33	156.	6483.	4.08	46.50	44.33
4	.38	850.86	.06	149.	6777.	.67	46.42	44.33
5	.38	850.86	.06	149.	6974.	.58	46.33	44.33
6	.38	850.85	.05	349.	7983.	.42	45.58	44.33

STATION 7				STATION 8				
PLAN	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS	RATIO	MAXIMUM FLOW,CFS	MAXIMUM STAGE,FT	TIME HOURS
1	.38	6472.	812.7	46.33	.38	6473.	809.8	46.33
2	.38	7575.	813.4	45.00	.38	7589.	811.5	45.00
3	.38	6482.	812.7	46.67	.38	6482.	809.8	46.67
4	.38	6776.	812.9	46.33	.38	6776.	810.3	46.33
5	.38	6978.	813.0	46.33	.38	6978.	810.6	46.33
6	.38	7912.	813.6	45.00	.38	7922.	812.0	45.00

## LIST OF REFERENCES

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14. Standard Mathematical Tables, 21st Edition, The Chemical Rubber Company, 1973, page 15.
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APPENDIX C-1  
SUPPLEMENTAL CALCULATIONS

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-24-79 PROJ. NO. 79-617-524  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 1 OF 20



BEAVER RUN DAM

DAM STATISTICS

HEIGHT OF DAM  $\approx 91\text{ FT} - 5\text{ FT} \approx 86\text{ FT}$  (SEE NOTE 1)  
(TO LOW TOP OF DAM)

MAXIMUM POOL STORAGE CAPACITY  $\approx 64,000\text{ AC-FT}$  (SEE NOTE 1)  
@ LOW TOP OF DAM (EL 1070.0  
RATHER THAN EL. 1075.0)

NORMAL POOL STORAGE CAPACITY  $\approx 34,000\text{ AC-FT}$  (SEE NOTE 1)  
@ TOP OF PRINCIPAL SPILLWAY (EL 1050)

DRAINAGE AREA  $\approx 43.2\text{ SQ. MI}$  (SEE NOTE 1)

NOTE 1: INFORMATION CONCERNING BEAVER RUN DAM WAS  
OBTAINED FROM "BEAVER RUN DAM, PHASE I INSPECTION  
REPORT, NATIONAL DAM INSPECTION PROGRAM"; PREPARED  
BY GAI CONSULTANTS, INC, MONROEVILLE, PA FOR THE  
DEPARTMENT OF ARMY, BALTIMORE DISTRICT CORPS OF  
ENGINEERS, JULY 1978. APPENDICES C, D, AND F.

DAM CLASSIFICATION

DAM SIZE - LARGE (REF 1, TABLE 1)  
(DUE TO STORAGE VOLUME)

HAZARD CLASSIFICATION - HIGH (FIELD OBSERVATION)

REQUIRED SDF - PMF (REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-31-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-18-79 SHEET NO. 2 OF 20



BEAVER RUN DAM

HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE  $\approx 14.3$  MI.

$L_{CA} \approx 6.3$  MI. (MEASURED ALONG THE LONGEST WATERCOURSE  
FROM THE DAM TO THE CENTROID OF THE BASIN)

NOTE 2: VALUES OF  $L$  AND  $L_{CA}$  ARE MEASURED FROM THE  
USGS 15 MINUTE FREEPORT AND GREENSBURG, PA  
QUADS. ALL VARIABLES ARE DEFINED IN REF. 2  
IN THE SECTION ENTITLED, "SNYDER SYNTHETIC  
UNIT HYDROGRAPH"

$C_t \approx 1.6$   
 $C_p \approx 0.45$

[ SUPPLIED BY COE; ZONE 24  
OHIO RIVER BASIN ]

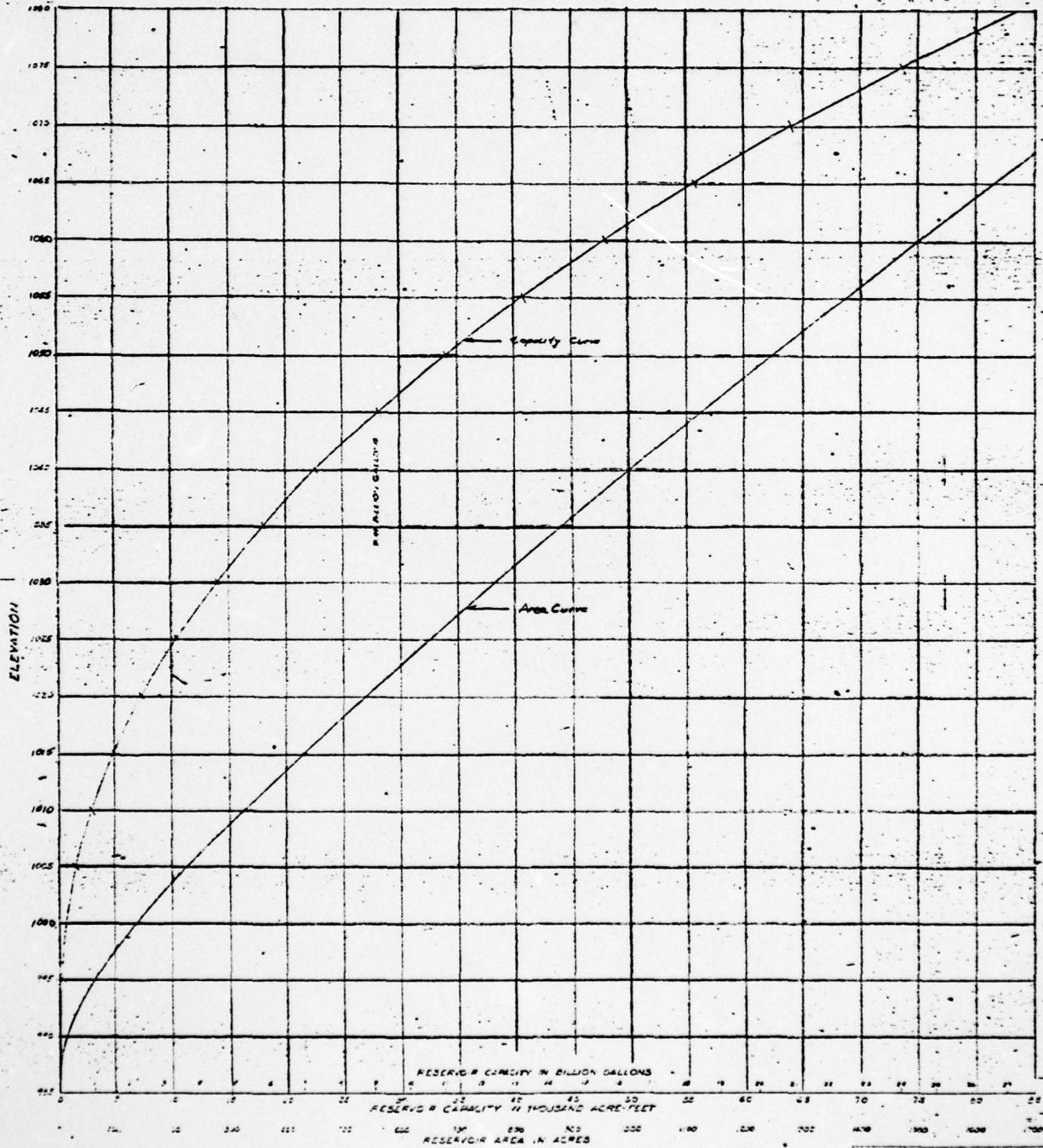
$t_p = \text{SNYDER'S STANDARD LAG} \approx 1.6 (L \times L_{CA})^{0.3}$

$\therefore t_p \approx 1.6 (14.3 \times 6.3)^{0.3} \approx 6.17$  HRS

RESERVOIR ELEVATION - STORAGE RELATIONSHIP

THE DESIGN CAPACITY CURVE AS FOUND IN THE  
REFERENCE GIVEN IN NOTE 1 (SHEET 1) WILL BE  
USED TO OBTAIN VALUES OF STORAGE FOR CORRESPONDING  
ELEVATIONS. THE CURVE IS REPRODUCED ON THE  
FOLLOWING SHEET.

# BEAVER RUN RESERVOIR ELEVATION VS STORAGE DESIGN CURVE (OBTAINED FROM DESIGN DRWGS)



050-6  
170

DESIGNED BY  
J.B.W.  
CHECKED BY  
J.B.W.  
APPROVED BY  
J.B.W.

MUNICIPAL AUTHORITY OF  
WESTMORELAND COUNTY  
GREENSBURG, PA.  
BEAVER RUN DAM  
LOCATION MAP AND  
CAPACITY CURVE  
SCALE AS SHOWN  
GANNETT FLEMING, CORRODY & CARPENTER  
ENGINEERS  
HARRISBURG, PA.

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 5-31-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 4 OF 20



BEAVER RUN DAM

PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 24 IN (REF 3, FIG 1)  
 (CORRESPONDING TO A DURATION OF 24 HR  
 AND AN AREA OF 200 SQ MI. LOCATED IN  
 SOUTHWESTERN PENNSYLVANIA)
- DEPTH - AREA - DURATION ZONE #7 (REF 3, FIG 1)
- LOCAL DRAINAGE AREA  $\approx$  43.2 sq. mi. HOWEVER, THE  
 STORM WILL BE CENTERED OVER THE TOTAL DRAINAGE  
 AREA ABOVE BEAVER DAM  $\approx$  54.4 SQ. MI.  $\Rightarrow$

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	95
12	103
24	113
48	124

(FROM REF 2  
FIG 2)

- HORNELER FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL  
 AS FOR THE LESSER LIKELIHOOD OF A SEVERE STORM  
 CENTERING OVER A SMALLER BASIN) CORRESPONDING TO  
 A DA  $\approx$  54.4 SQ MI  $\Rightarrow$  0.852 (AS COMPUTED BY HFC-1)

AD-A078 900

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NATIONAL DAM INSPECTION PROGRAM. BEAVER DAM (NDI I.D. NUMBER PA--ETC(U)

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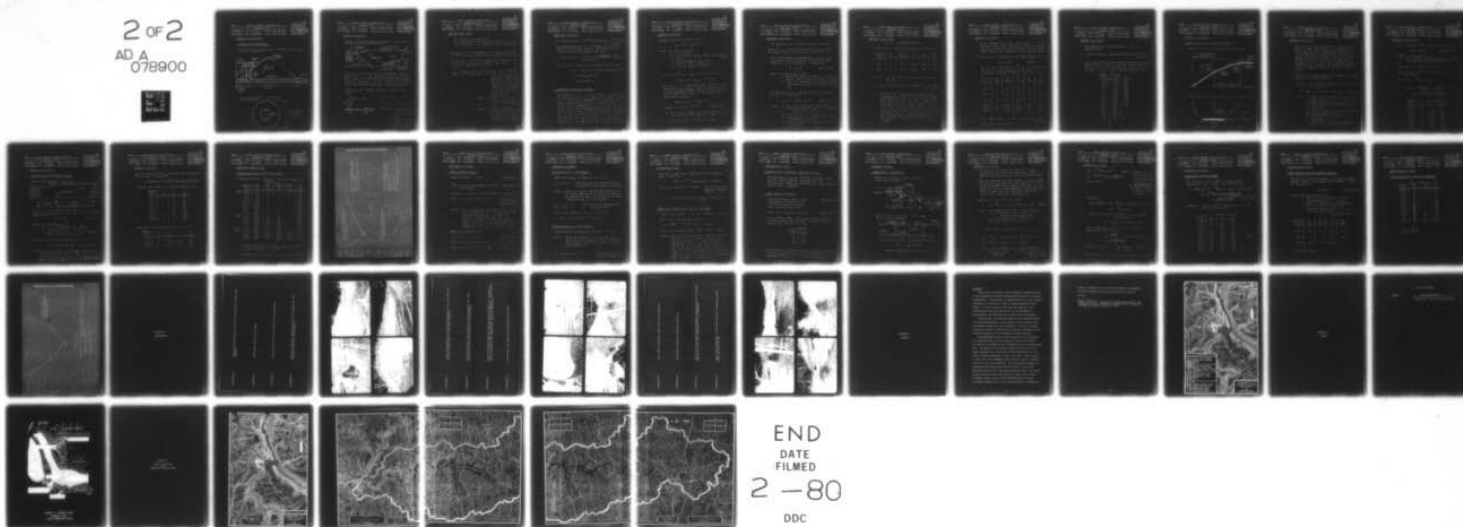
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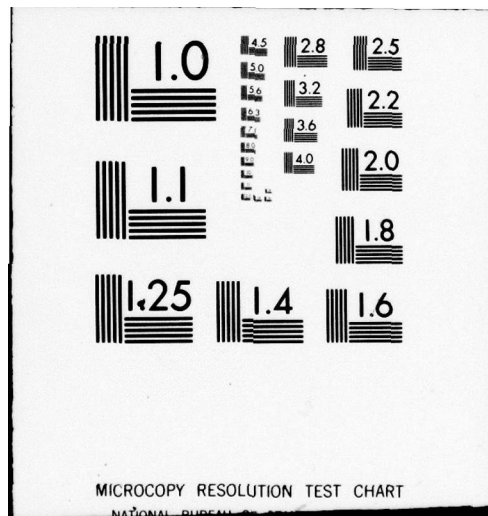
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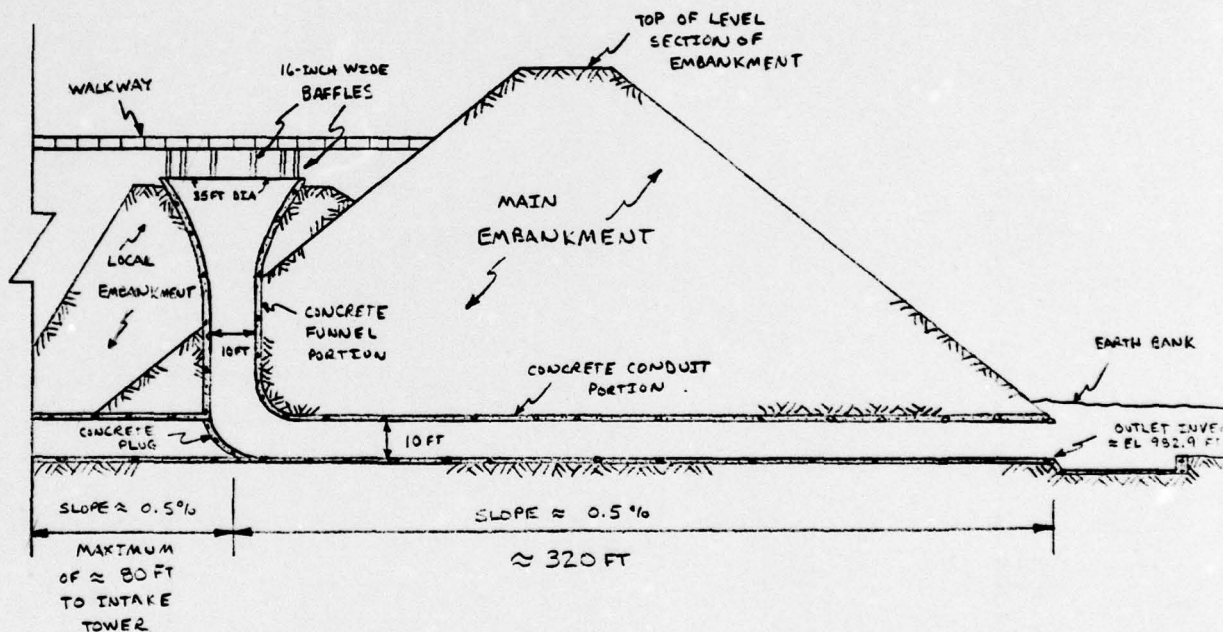
SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-4-79 PROJ. NO. 78-617-452  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 5 OF 20

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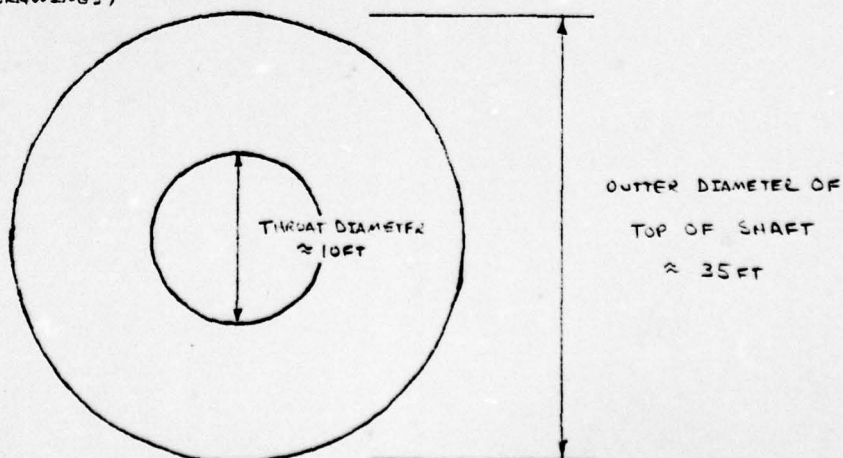
BEAVER RUN DAM

SPILLWAY CAPACITY

- SECTION THROUGH MORNING GLORY SPILLWAY : (NOT TO SCALE)  
 (FROM DESIGN DRAWINGS)



- TOP VIEW OF SPILLWAY : (NOT TO SCALE)  
 (FROM DESIGN DRAWINGS)



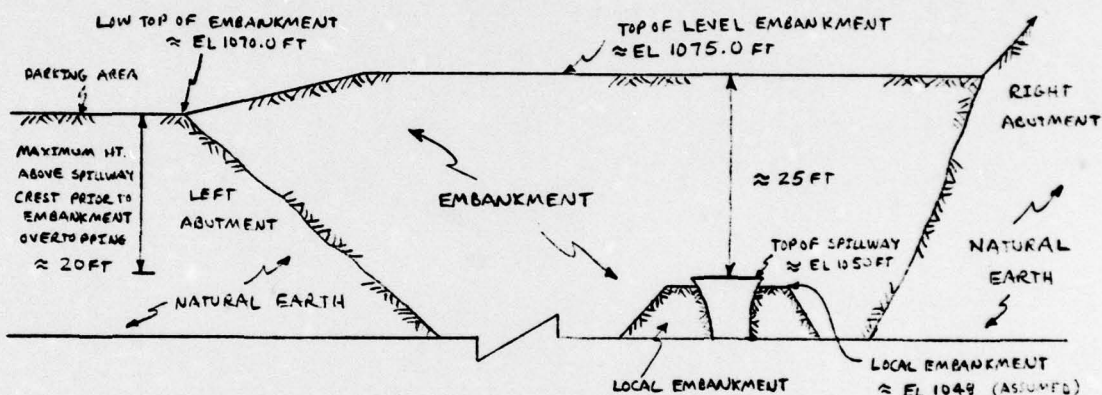
SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-6-79 PROJ. NO. 73-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 6 OF 20



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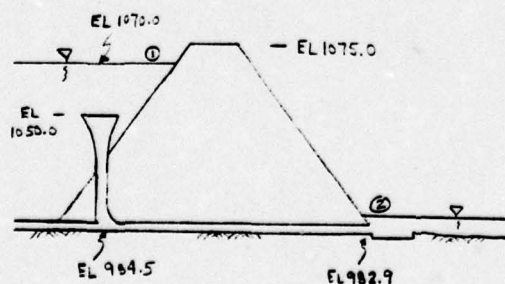
### BEAVER RUN DAM

- PROFILE OF EMBANKMENT RELATIVE TO SPILLWAY: (NOT TO SCALE)  
 (FROM DESIGN DRAWINGS AND FIELD OBSERVATION)



- SINCE DESIGN CALCULATIONS ARE NOT AVAILABLE, THE ACTUAL DESIGN DISCHARGE AND HEAD ARE UNKNOWN. HOWEVER, IT IS SAFE TO ASSUME THAT BY THE TIME THE RESERVOIR RISES TO ELEVATION 1070.0 FT (20 FT ABOVE THE SPILLWAY CREST) THE OUTLET CONDUIT WILL BE FLOWING FULL.

- ENERGY BALANCE BETWEEN SECTIONS ① AND ② SHOWN BELOW:



$$\frac{P_1}{\gamma} + \frac{V_1^2}{2g} + Z_1 = \frac{P_2}{\gamma} + \frac{V_2^2}{2g} + Z_2 + H_L \quad (\text{REF. 13, p. 1})$$

WHERE  $\frac{P_1}{\gamma}$  = PRESSURE @ ① = 0  
 (ATMOSPHERIC PRESSURE)  
 $V_1$  = VELOCITY OF RESERVOIR  
 $\approx 0$  FPS;  
 $Z_1$  = ELEVATION OF REFERENCE  
 SURFACE = 1070.0 FT  
 $\frac{P_2}{\gamma}$  = PRESSURE @ ② = 0  
 (ATMOSPHERIC PRESSURE);

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM

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BEAVER RUN DAM

$v_2$  = VELOCITY @ OUTLET IN FPS

$z_2$  = ELEVATION OF TAILWATER ON OUTLET IN FT; AND

$H_L$  = TOTAL HEAD LOSS = ENTRANCE + BEND + FRICTION LOSSES

ASSUME THAT THE TAILWATER IS JUST ABOVE THE CROWN  
OF THE 10-FT DIAMETER OUTLET CONDUIT  $\Rightarrow z_2 \approx 142.51$

THE VELOCITY,  $v_2$ , OF THE CONDUIT IS A FUNCTION OF  
FLOW AND CROSS-SECTIONAL AREA  $\Rightarrow v_2 \approx Q/A_2$   
w/  $A_2 \approx \pi (10\text{ft})^2/4 \approx 78.5 \text{ ft}^2$

TOTAL HEAD LOSS IS A FUNCTION OF CONDUIT VELOCITY  
HEAD ( $v_2^2/2g$ )  $\Rightarrow$  ENTRANCE  $\approx 0.3 v_2^2/2g$  (ALTHOUGH THE  
EDGES OF THE SHAFT ENTRANCE  
ARE ROUNDED, A LARGE COEFFICIENT  
WAS CHOSEN TO TAKE INTO ACCOUNT  
THE EFFECTS OF THE 12 RAFFLES,  
THE WALKWAY, AND THE PROJECTIONS  
OF THE SHAFT FROM THE FILL  
ON THE EFFICIENCY OF ENTRANCE  
REF 5, PG 6-19);

BEND  $\approx 0.2 v_2^2/2g$  (90° BEND w/ BEND  
RADIUS - PIPE DIAMETER RATIO  
( $R/D$ )  $\approx 20/10 \approx 2$ ; REF 5 PAGE 6-19)

FRICTION  $\approx [29 n^2 L / R^{4/3}] v_2^2/2g$  (WHERE  
 $n$  = MANNING'S ROUGHNESS COEFFICIENT  
 $\approx 0.013$  FOR CONCRETE,  $L$  = TOTAL  
LENGTH OF SHAFT + CONDUIT  
 $\approx 65.5 \text{ ft} + 320 \text{ ft} \approx 385.5 \text{ ft}$ ;

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-6-79 PROJ. NO. 78-617-453  
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### BEAVER RUN DAM

$$R = \text{HYDRAULIC RADIUS} = \frac{\text{FLOW AREA}}{\text{WETTED PERIMETER}} \approx \frac{78.5 \text{ FT}^2}{\pi (10 \text{ FT})} \approx 2.5 \text{ FT}$$

(FRICTION RELATIONSHIP OBTAINED FROM "HYDRAULIC CHARTS FOR THE SELECTION OF HIGHWAY CULVERTS", HEC N° 3, U.S. DEPT. OF COMMERCE, BUREAU OF PUBLIC ROADS. 1965)

$$\therefore \text{TOTAL HEAD LOSS} \approx \left[ 0.8 + 0.2 + \frac{29(0.013)^2(385.5)}{(2.5)^{4.75}} \right] \frac{Q^2}{29(78.5)^2} \approx (3.93 \times 10^{-6}) \times Q^2$$

- THUS, DISCHARGE CAPACITY CAN BE FOUND FROM THE RELATIONSHIP

$$1070.0 \text{ FT} = \frac{Q^2}{29(78.5)^2} + 192.9 \text{ FT} + 0.00000393 Q^2$$

$$77.1 \approx (6.45 \times 10^{-6}) \times Q^2$$

$$Q \approx 3460 \text{ CFS}$$

### SPILLWAY RATING CURVE

AN ATTEMPT TO BACK-CALCULATE THE DESIGN DISCHARGE AND HEAD ACCORDING TO THE USBR METHOD (REF 4, PG 425-43) PROVED TO BE FUTILE. PERTINENT DATA OBTAINED FROM THE DESIGN DRAWINGS DID NOT SEEM TO CONFORM TO THE USBR RELATIONSHIPS. THEREFORE, IN ORDER TO ESTIMATE THE DESIGN PARAMETERS, MANNING'S EQUATION WILL BE APPLIED TO THE 320-FT LENGTH OF CONDUIT IN ORDER TO DETERMINE ITS 75% FULL CAPACITY. (THE CONDUIT SHOULD HAVE BEEN DESIGNED TO PASS THE DESIGN FLOW @ 75% OF ITS CAPACITY SO AS TO HELP AVOID SIPHONIC FLOW CONDITIONS, SINCE IT DOES NOT APPEAR THAT THE CONDUIT IS AIRATED.)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-6-79 PROJ. NO. 73-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 9 OF 20



BEAVER RUN DAM

MANNING EQUATION (REF 7, PG 129):

$$Q = 1.49/n A R^{2/3} S^{1/2}$$

WHERE  $Q$  = DISCHARGE, IN CFS;

$n \approx 0.013$  (SHEET 7);

$A \approx 75\%$  OF TOTAL CONDUIT AREA  $\approx 0.75(79.5 \text{ FT}^2)$   
 $\approx 59.6 \text{ FT}^2$  ↳ SHEET 7

$R \approx$  HYDRAULIC RADIUS @ 75% CAPACITY

$\approx 2.97 \text{ FT}$  (REF 4, PG 551); AND

$S \approx$  SLOPE OF CONDUIT  $\approx 0.5\%$

$$\therefore Q \approx 1.49/0.013 (59.6 \text{ FT}^2) (2.97 \text{ FT})^{2/3} (0.005)^{1/2}$$

$$\Rightarrow \text{ASSUMED } Q_{\text{DESIGN}} \approx 990 \text{ CFS}$$

- ACCORDING TO THE DESIGN DRAWINGS, THE THROAT OF THE SHAFT IS LOCATED @ ABOUT EL 1009.0 FT AND IS A 10-FT DIAMETER OPENING. IF THE DESIGN DISCHARGE OCCURS DURING "THROAT CONTROL", THE DESIGN HEAD ELEVATION WOULD BE :

$$\text{ELEVATION } H_0 \approx 1009.0 + H_a$$

$$\text{WHERE } H_a \approx [0.204 Q^{1/2}/R]^4 \quad (\text{REF 4, PG 421})$$

W/  $Q$  = ASSUMED DESIGN DISCHARGE  $\approx 990 \text{ CFS}$ , AND  
 $R$  = RADIUS OF THROAT SECTION  $\approx 5 \text{ FT}$

$$\therefore H_a \approx [0.204 (990)^{1/2}/5]^4 \approx 2.7 \text{ FT}$$

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-6-79 PROJ. NO. 79-617-453  
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BEAVER RUN DAM

$$\Rightarrow \text{ELEVATION } H_0 = 1009.0 + 2.7 \text{ FT} \approx 1011.7 \text{ FT}$$

SINCE THE CREST OF THE SPILLWAY IS @ EL 1050 FT  
 $\Rightarrow$  DESIGN HEAD IS NOT CONTROLLED BY THE THROAT.

- THE ASSUMED DESIGN DISCHARGE MUST OCCUR AS WEIR FLOW OVER THE CIRCULAR LIP OF THE SHAFT. THE WEIR FLOW CAN BE DEFINED BY THE EQUATION:

$$Q = C L H^{3/2} \quad (\text{REF 4, PG 415})$$

WHERE  $Q$  = DISCHARGE IN CFS;  
 $L$  = EFFECTIVE LENGTH OF WEIR CREST, WHICH EQUALS  $2\pi R_s - (\text{OBSTRUCTION WIDTHS})$  IN FT; AND  
 $C$  = DISCHARGE COEFFICIENT =  $f$  (DESIGN HEAD,  $H_0$ , SHAFT ENTRANCE RADIUS,  $R_s$ , AND FOREBAY DEPTH,  $P$ ).

THE EFFECTIVE LENGTH OF THE CIRCULAR WEIR CREST CAN BE OBTAINED FROM:

$$L = L' - 2(NK_p + K_a) H_c \quad (\text{REF 4, PG 373})$$

WHERE  $L'$  = NET LENGTH OF CREST =  $(2\pi R_s) - (12 \times 16)$   
 $= (2\pi \times 17.5 \text{ FT}) - (12 \times \frac{16}{12}) \approx 94 \text{ FT};$   $\hookrightarrow$  12 BAFFLES, 16 IN WID.  
 $\hookrightarrow$  SEE SKETCH ON SHEET 5

$N$  = NUMBER OF PIERS OR BAFFLES = 12;  
 $K_p$  = BAFFLE CONTRACTION COEFFICIENT  $\approx 0.02$   
 (FOR SQUARE-EDGED BAFFLES);  
 $K_a$  = ABUTMENT CONTRACTION COEFFICIENT  $\approx 0.0$   
 (NO ABUTMENT);  
 $H_c$  = TOTAL HEAD ON CREST, IN FT.

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

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CHKD. BY DLB DATE 6-18-79 SHEET NO. 11 OF 20



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BEAVER RUN DAM

$$L \approx 94 - 2 [(12 \times 0.02) + 0.0] H_e$$

- COMPUTATION OF ASSUMED DESIGN HEAD (FOR  $Q \approx 990 \text{ CFS}$ ):

ELEVATION (FT)	$H_o$ (FT)	$H_o/R_s$ (FT/FT)	$C_o^*$	L (FT)	Q (CFS)
1050.0	0	0	-	-	0
1051.0	1	0.06	4.05	94	390
1052.0	2	0.11	4.00	93	1050

\*  $C_o = f(H_o/R_s; P/R_s; \text{REF 4, PG 417, FIG 293})$ . ASSUME  $P/R_s \geq 2$

$\therefore$  ASSUME THAT THE DESIGN HEAD  $\approx 1.9 \text{ FT}$  (BY INTERPOLATE)  
SAY 2.0 FT

$\Rightarrow$  THE SHAFT AND THROAT SECTIONS ARE GREATLY OVERDESIGNED W/ RESPECT TO THE OUTLET CONDUIT SINCE THEIR CAPACITIES ARE MUCH GREATER THAN THE CONDUIT CAPACITY. THEORETICALLY, THE CIRCULAR WEIR WILL NOT BE SUBMERGED UNLESS A HEAD OF ABOUT 7.9 FT ( $\Rightarrow H_o/R_s \approx 0.45$ ) WAS USED FOR DESIGN. THEREFORE, THE ABOVE COMPUTED 2.0-FT DESIGN HEAD IS PROBABLY NOT THE CORRECT DESIGN HEAD, BUT IT IS ABOUT THE HIGHEST HEAD OBTAINABLE PRIOR TO THE POSSIBILITY OF SLUG FLOW IN THE OUTLET CONDUIT

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJY DATE 6-7-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 12 OF 20



BEAVER RUN DAM

- IT IS EVIDENT THAT THE THROAT WILL NOT CONTROL DISCHARGES FROM THIS SPILLWAY. THEREFORE, OUTFLOW WILL BE DEFINED BY CIRCULAR WEIR FLOW FOR LOWER HEADS, AND BY FULL BARREL FLOW FOR HIGHER HEADS.
- WEIR CONTROL ELEVATION DISCHARGE RELATIONSHIP:

$$Q = CLH_e^{3/2} \quad (\text{SHEET 10})$$

ASSUME THAT THE DESIGN  $H_0/R_s \approx 0.3$  ( $H_0 \approx 5.3\text{ft}$ )  
 FOR SIMPLICITY OF CALCULATIONS  $\Rightarrow$  THE "C"  
 COEFFICIENT  $\approx 3.75$  ( $H_0/R_s \geq 2.0$ ; REF 4, PG 417, FIG 283)

ELEVATION (FT)	$H_e$ (FT)	$H_e/R_s$ (FT/FT)	* C	** L (FT)	Q
1050.0	0	-	-	-	0
1051.0	1	0.06	3.30	94	310
1052.0	2	0.11	3.49	93	920
1053.0	3	0.17	3.64	93	1760
1054.0	4	0.23	3.71	92	2730
1054.3 <sup>+</sup>	4.3 <sup>+</sup>	0.25 <sup>+</sup>	3.72	92	3090
1055.0	5	0.29	3.75	92	3560

\*  $C = 3.75 \times C/C_{0.3}$  w/  $C/C_{0.3}$  OBTAINED FROM REF 4,  
 PG 421, FIG 284

\*\* SEE SHEET 10 FOR RELATIONSHIP

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-7-79 PROJ. NO. 73-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 13 OF 20



BEAVER RUN DAM

- FULL BARREL FLOW CONTROL ELEVATION - DISCHARGE  
 RELATIONSHIP:

$$\text{ELEVATION RESERVOIR} - \text{ELEVATION TAILWATER} \approx (6.45 \times 10^{-6}) \times Q^2$$

(SHEETS 6, 7, & 8)

ASSUME THAT THE TAILWATER REMAINS RELATIVELY CONSTANT  
 @ EL 992.9 FT UNTIL THE RESERVOIR REACHES EL 1070.0 FT.  
 ALSO ASSUME THAT THE TAILWATER LEVEL INCREASES BY 1 FT  
 FOR EVERY 1 FT OF RESERVOIR RISE ABOVE EL 1070.0 FT.

RESERVOIR ELEVATION (FT)	TAILWATER ELEVATION (FT)	Q (CFS)
1053.0	992.9	3050
1054.0	992.9	3080
1054.3 <sup>+</sup>	992.9	3090
1055.0	992.9	3100
1060.0	992.9	3230
1065.0	992.9	3340
1070.0	992.9	3460
1071.0	993.9	3460
1072.0	994.9	3460
1073.0	995.9	3460
1074.0	996.9	
1075.0	997.9	
1076.0	998.9	
1077.0	999.9	
1078.0	1000.9	

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-7-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 14 OF 20

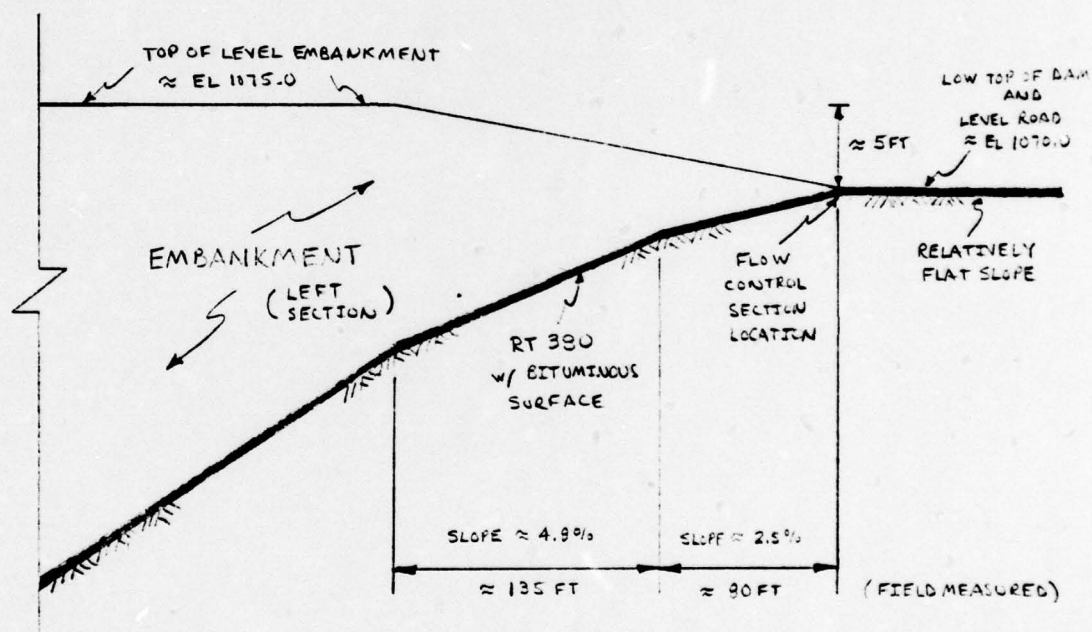


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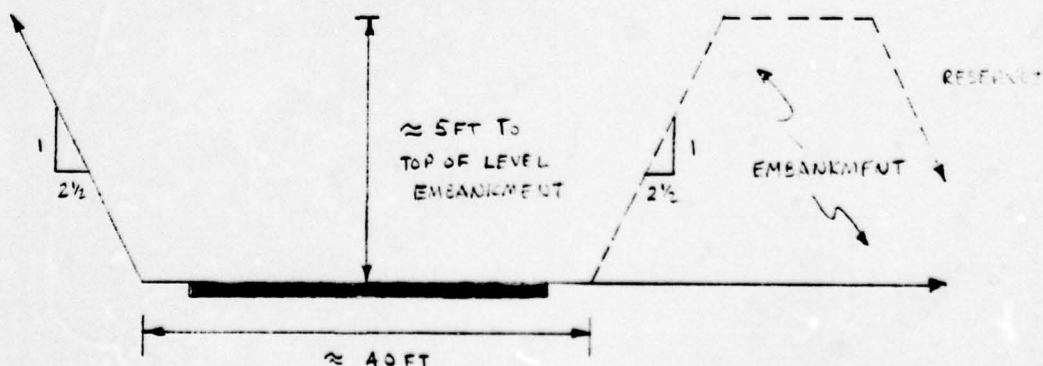
BEAVER RUN DAM

DISCHARGE CAPABILITIES OF RT 380

- PROFILE OF RT 380 "CHUTE CHANNEL": (NOT TO SCALE)



- CROSS-SECTION OF RT 380 CONTROL SECTION: (NOT TO SCALE)



SECTION TAKEN LOOKING DS FROM CONTROL SECTION

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-7-79 PROJ. NO. 79-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 15 OF 20



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BEAVER RUN DAM

- THE LOW TOP OF DAM ELEVATION IS LOCATED @ THE INVERT OF THE CONTROL SECTION. AS THE RESERVOIR RISES ABOVE EL 1070.0, PROGRESSIVELY LARGER PORTIONS OF THE EMBANKMENT ARE OVERTOPPED. THE MAXIMUM LENGTH OF OVERTOPPING PRIOR TO OVERTOPPING OF THE ENTIRE EMBANKMENT (@ EL 1075.0) IS ABOUT 215 FT OR ABOUT 20% OF OF THE ENTIRE EMBANKMENT LENGTH. THEREFORE, THE DRAINAGE WAY CANNOT BE CONSIDERED TO BE AN EMERGENCY SPOILWAY IN THE STRICTEST SENSE.
- CRITICAL FLOW RELATIONSHIPS WILL GOVERN THE DISCHARGE THROUGH THE CONTROL SECTION:

ENERGY BALANCE BETWEEN THE CONTROL SECTION AND A SECTION JUST UPSTREAM  $\Rightarrow$

$$Y_1 + \frac{U_1^2}{2g} + Z_1 = Y_c + \frac{U_c^2}{2g} + Z_2 + H_L \quad (\text{REF 7, PG 40})$$

WHERE  $Y_1$  = DEPTH OF WATER IN THE UPSTREAM SECTION  
 $\approx$  ELEVATION OF RESERVOIR - 1070.0 FT;  
 $U_1$  = APPROACH VELOCITY OF RESERVOIR  $\approx$  0 FPS;  
 $Z_1$  = INVERT ELEVATION OF UPSTREAM SECTION  
 $\approx$  1070.0 FT;  
 $Y_c$  = CRITICAL DEPTH @ CONTROL SECTION, IN FT;  
 $U_c$  = CRITICAL VELOCITY, IN FPS;  
 $Z_2$  = INVERT ELEVATION OF CONTROL SECTION  
 $\approx$  1070.0 FT; AND  
 $H_L$  = TOTAL ENERGY LOSS BETWEEN SECTIONS  
 $\approx$  0 (SECTIONS ARE CLOSE TOGETHER).

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-7-79 PROJ. NO. 73-617-452  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 16 OF 20



BEAVER RUN DAM

ALSO @ CRITICAL FLOW (FOR THE CONTROL SECTION)  $\Rightarrow$

$$Q^2 B_c = g A_c^3 \quad (\text{REF 13, PG 141})$$

WHERE  $Q$  = DISCHARGE, IN CFS;  
 $B_c$  = TOPWIDTH OF CRITICAL WATER SURFACE, IN FT; AND  
 $A_c$  = AREA OF CRITICAL FLOW, IN  $\text{FT}^2$ .

$$B_c \approx 40 + 2.5 Y_c + 2.5 Y_c \approx 40 + 5 Y_c$$

$$A_c \approx (40 \times Y_c) + \frac{1}{2} (2.5 Y_c \times Y_c) + \frac{1}{2} (2.5 Y_c \times Y_c) \\ \approx 40 Y_c + 2.5 Y_c^2$$

$$V_c \approx Q/A_c \approx Q/(40 Y_c + 2.5 Y_c^2)$$

$$\therefore Y_1 = Y_c + \frac{Q^2}{2g [(40 Y_c + 2.5 Y_c^2)]^2} + (1070.0 - 1070.0)$$

$$\text{AND } Q = \sqrt{g (40 Y_c + 2.5 Y_c^2)^3 / (40 + 5 Y_c)}$$

RESERVOIR ELEVATION (FT)	$Y_1$ (FT)	FINAL ASSUMED $Y_c$ (FT)	FINAL ASSUMED $Q$ (CFS)
1070.0	0	-	0
1071.0	1	0.67	130
1072.0	2	1.37	380
1073.0	3	2.07	720
1074.0	4	2.79	1160
1075.0	5	3.51	1680
1076.0	6	4.25	2290
1077.0	7	4.99	2980
1078.0	8	5.73	3760

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

BY WJV DATE 6-9-79 PROJ. NO. 78-G17-453

CHKD. BY DLB DATE 6-18-79 SHEET NO. 17 OF 20

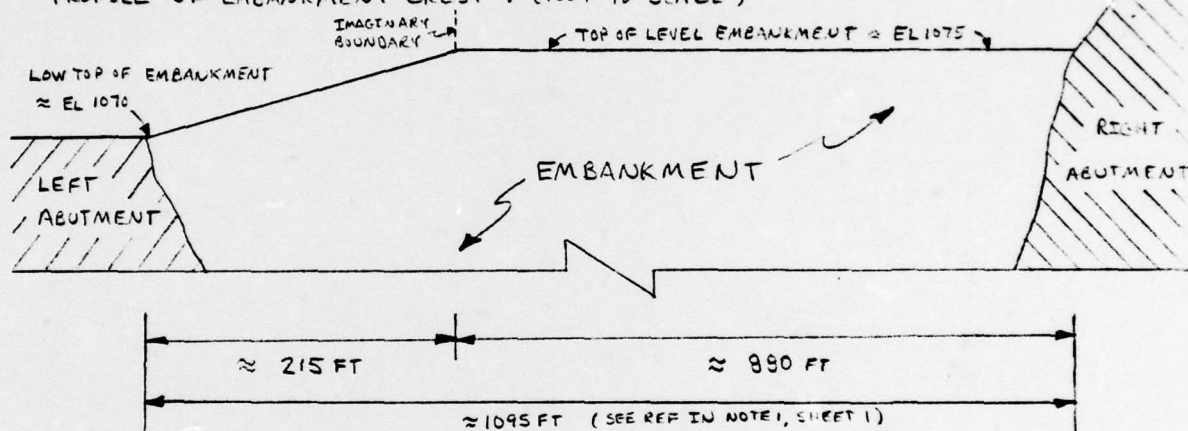
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BEAVER RUN DAM

EMBANKMENT RATING CURVE

- PROFILE OF EMBANKMENT CREST : (NOT TO SCALE)



- ASSUME THAT THE EMBANKMENT ACTS LIKE A BROAD-CRESTED WEIR WHEN OVERTOPPED W/ DISCHARGES DEFINED BY: (FOR THE LEVEL EMBANKMENT PORTION)

$$Q = CLH_1^{3/2} \quad (\text{REF 5, PG 5-23})$$

WHERE  $Q$  = DISCHARGE, IN CFS;  
 $L$  = LENGTH OF EMBANKMENT CREST  $\approx 880$  FT;  
 $H_1$  = ELEVATION OF RESERVOIR - EL 1075.0 FT;  
 $C$  = DISCHARGE COEFFICIENT =  $\{ (H/L \text{ w/ } L = \text{WIDTH OF CREST} \approx 22 \text{ FT; AND REF 12, PG 46}) \}$ .

AND (FOR THE INCLINED EMBANKMENT PORTION), ASSUME

$$Q = [C_1 \tan^{9/2} H_2^{2.5}] / 2 \quad (\text{REF 5, PG 5-4})$$

WHERE  $Q$  = DISCHARGE, IN CFS;  $9/2$  = ANGLE WHICH INCLINED CREST MAKES W/ A VERTICAL LINE  $\approx 88.7^\circ \Rightarrow \tan^{9/2} \approx \frac{215 \text{ FT}}{5 \text{ FT}} \approx 43$ ;  $H$  = RESERVOIR ELEVATION - 1170.0 FT; AND  $C_1$  = DISCHARGE COEFFICIENT, ASSUMED TO BE EQUAL TO:  $2.5$  (FOR SHARP-CRESTED V-NOTCH, REF 5, PG 5-16)  $\times \frac{3.09}{3.33}$  (BROAD-CRESTED RECTANGULAR REF 5, PGS 5-24 AND 5-7)  $\approx 2.32$

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-8-79 PROJ. NO. 73-617-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 18 OF 20



BEAVER RUN DAM

HOWEVER, ABOVE EL 1075.0 FT, DISCHARGE OVER THE INCLINED CREST PORTION IS DEFINED BY :

$$Q = [(2.32 \tan^{\theta/2} H_2^{2.5})/2] - [(2.32 \tan^{\theta/2} H_1^{2.5})/2]$$

- INCLINED CREST ELEVATION - DISCHARGE RELATIONSHIP :

RESERVOIR ELEVATION (FT)	H <sub>1</sub> (FT)	H <sub>2</sub> (FT)	Q (CFS)
1070.0	-	0	0
1071.0	-	1	50
1072.0	-	2	230
1073.0	-	3	780
1074.0	-	4	1600
1075.0	-	5	2790
1076.0	1	6	4350
1077.0	2	7	6190
1078.0	3	8	8250

- LEVEL CREST ELEVATION - DISCHARGE RELATIONSHIP :

RESERVOIR ELEVATION (FT)	H <sub>1</sub> (FT)	H/L (FT/FT)	C	Q (CFS)
1075.0	0	-	-	0
1076.0	1	0.05	3.03	2670
1077.0	2	0.10	3.04	7570
1078.0	3	0.14	3.05	13950

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-7-79 PROJ. NO. 79-G17-453  
 CHKD. BY DLB DATE 6-18-79 SHEET NO. 19 OF 20



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BEAVER RUN DAM

TOTAL FACILITY RATING CURVE

$$\text{TOTAL DISCHARGE} = Q_{\text{SPILLWAY}} + Q_{\text{RT 380}} + Q_{\text{INCLINED CREST}} + Q_{\text{LEVEL CREST}}$$

	RESERVOIR ELEVATION (FT)	① SPILLWAY Q (CFS)	② RT 380 Q (CFS)	③ INCLINED CREST Q (CFS)	④ LEVEL CREST Q (CFS)	TOTAL Q (CFS)
NORMAL POOL	- 1050.0	0	-	-	-	0
	1051.0	310	-	-	-	310
	1052.0	920	-	-	-	920
	1053.0	1760	-	-	-	1760
	1054.0	2730	-	-	-	2730
*	1054.3	3090	-	-	-	3090
	1055.0	3100	-	-	-	3100
	1060.0	3230	-	-	-	3230
	1065.0	3340	-	-	-	3340
LOW TOP OF DAM	- 1070.0	3460	0	0	-	3460
	1071.0	3460	130	50	-	3640
	1072.0	3460	390	230	-	4120
	1073.0	3460	720	780	-	4960
	1074.0	3460	1160	1600	-	6220
TOP OF LEVEL CREST	- 1075.0	3460	1690	2790	0	7930
	1076.0	3460	2290	4350	2670	12770
	1077.0	3460	2490	6190	7570	20190
	1078.0	3460	3760	8250	13750	29420

\* TRANSITION ELEVATION BETWEEN WEIR FLOW AND  
 FULL BARREL FLOW FOR THE SPILLWAY

① SHEETS 12 & 13 , ② SHEET 16 , ③ SHEET 18 , ④ SHEET 19

# DOWNSTREAM ROUTING SECTIONS

SHEET 20 OF 23

CROSS SECTION INFORMATION OBTAINED  
FROM FIELD OBSERVATION AND  
USGS TOPIC MAP

SECTION 2 @ 27,700 FT DS FROM  
BEAVER RUN DAM  
INVERT @ 900 FT  
NEW @ 0.085; OLD @ 0.08; NEW @ 0.09  
CHANNEL SLOPE @ 0.2%

STATION (FT)

CROSS SECTION INFORMATION OBTAINED  
FROM FIELD OBSERVATION AND  
USGS TOPIC MAP

SECTION 3 @ 27,700 FT DS FROM  
BEAVER RUN DAM  
(@ 2000) FT DS FROM SECTION 2  
INVERT @ 940 FT  
NEW @ 0.035; OLD @ 0.10  
CHANNEL SLOPE @ 0.009  
SECTION LOCATED JUST ABOVE BEAVER  
DAM FLOOD POOL

STATION (FT)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM

BY WJV DATE 5-25-79 PROJ. NO. 78-617-453

CHKD. BY DLB DATE 6-12-79 SHEET NO. 1 OF 11



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## GILKERSON DAM

### DAM STATISTICS

HEIGHT OF DAM  $\approx$  19 FT

(SEE NOTE 1)

MAXIMUM POOL STORAGE CAPACITY  $\approx$  50 AC-FT (FROM HEC-1)  
@ TOP OF DAM

NORMAL POOL STORAGE CAPACITY  $\approx$  30 AC-FT (SEE NOTE 1)

DRAINAGE AREA  $\approx$  0.33 SQ MI.

PLANIMETERED OFF  
USGS 7.5 MINUTE  
VANDEGRIFT, PA QUAD

NOTE 1: STORAGE VALUE OBTAINED FROM "REPORT ON THE APPLICATION OF THE APOLLO WATERWORKS COMPANY FOR PERMISSION TO CONSTRUCT A DAM ON A TRIBUTARY OF BEAVER RUN, NEAR APOLLO, ARMSTRONG COUNTY, PENNSYLVANIA" AS FOUND IN PENN DEIR FILES. THE ACTUAL REPORTED VALUE WAS 10 MILLION GALLONS. ALSO, HEIGHT OF DAM OBTAINED FROM SAME REFERENCE.

### DAM CLASSIFICATION

DAM SIZE - SMALL

(REF 1, TABLE 1)

HAZARD CLASSIFICATION - HIGH

(FIELD OBSERVATION)

REQUIRED EDF - 1/2 PMF TO PMF

(REF 1, TABLE 3)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-30-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-12-79 SHEET NO. 2 OF 11



GILKERSON DAM

HYDROGRAPH PARAMETERS

LENGTH OF LONGEST WATERCOURSE  $\approx 0.8$  MI

$L_{CA} \approx 0.4$  MI (MEASURED ALONG THE LONGEST WATERCOURSE  
FROM THE DAM TO THE CENTROID OF THE BASIN)

NOTE 2: VALUES OF  $L$  AND  $L_{CA}$  ARE MEASURED FROM THE USGS  
7.5 MINUTE VANDERGRIFF, PA QUAD. ALL VARIABLES  
ARE DEFINED IN REF. 2 IN THE SECTION ENTITLED,  
"SNYDER SYNTHETIC UNIT HYDROGRAPH".

$$\left. \begin{array}{l} C_+ \approx 1.6 \\ C_p \approx 0.45 \end{array} \right\} \left[ \begin{array}{l} \text{SUPPLIED BY THE COE; ZONE 24} \\ \text{OHIO RIVER BASIN} \end{array} \right]$$

$$t_p = \text{SNYDER'S STANDARD LAG} \approx 1.6 (L \times L_{CA})^{0.3}$$

$$\therefore t_p \approx 1.6 (0.8 \times 0.4)^{0.3} \approx 1.14 \text{ HRS}$$

RESERVOIR SURFACE AREAS

SURFACE AREA (SA) @ NORMAL POOL EL. 1023 FT  $\approx 3.6$  AC

NOTE 3: NORMAL POOL ELEVATION OBTAINED FROM THE  
REFERENCE GIVEN IN NOTE 1 (SHEET 1). SURFACE AREA  
VALUE MEASURED OFF DESIGN DRAWINGS AS FOUND  
IN PENNDEK FILES

SA @ EL 1040 FT  $\approx 16.1$  AC

[PLANIMETERED OFF USGS 7.5  
MINUTE VANDERGRIFF, PA QUAD]

SUBJECT

DAM SAFETY INSPECTION

BEAVER DAM

BY WJV

DATE

5-31-79

PROJ. NO.

78-617-453

CHKD. BY DLB

DATE

6-12-79

SHEET NO.

3

OF

11

Engineers • Geologists • Planner  
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RISE ( $\Delta A/\Delta H$ )  $\Rightarrow$ 

$$\Delta A/\Delta H \approx (16.1 - 3.6) \text{ AC} / (1040 - 1023) \text{ FT} \approx 0.74 \text{ AC/FT}$$

TOP OF DAM ELEVATION  $\approx 1027 \text{ FT}$  (FROM AVAILABLE DESIGN  
DRAWINGS TO PENNDER  
FILES)

$$\therefore \text{SA @ TOP OF DAM EL } 1027 \text{ FT} \approx 3.6 \text{ AC} + [(0.74 \text{ AC/FT}) \times (1027 - 1023)] \\ \approx 6.6 \text{ AC}$$

RESERVOIR ELEVATION @ "O" STORAGENORMAL POOL VOLUME  $\approx \frac{1}{3} \text{ HA} \approx 30 \text{ AC-FT}$  (CONIC METHOD)SA @ NORMAL POOL EL 1023  $\approx 3.6 \text{ AC}$ 

$$\therefore H \approx \frac{3V}{A} \approx (3)(30 \text{ AC-FT}) / (3.6 \text{ AC}) \approx 25 \text{ FT}$$

ZERO VOLUME ELEVATION  $\approx 1023 \text{ FT} - 25 \text{ FT} \approx 998 \text{ FT}$ 

NOTE 4: ALTHOUGH THE ACTUAL MINIMUM ELEVATION OF THE RESERVOIR IS ABOUT 1009 FT (ACCORDING TO DESIGN DRAWINGS), IN ORDER TO COMPUTE AN ELEVATION-STORAGE RELATIONSHIP AND STILL MAINTAIN A STORAGE OF 30 AC-FT @ EL 1023 FT, THE ABOVE "O" STORAGE ELEVATION MUST BE INPUT INTO THE HEC-1 PROGRAM. (THE ERROR IN POSSIBLE BREACH OUTLET CAUSED BY THIS ASSUMPTION WILL HAVE AN INSIGNIFICANT EFFECT ON DOWNSTREAM BEAVER DAM.)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
BY WJV DATE 5-31-79 PROJ. NO. 78-617-453  
CHKD. BY DLB DATE 6-12-79 SHEET NO. 4 OF 11



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## GILKERSON DAM

### ELEVATION - STORAGE RELATIONSHIP

COMPUTED INTERNALLY BY THE HEC-1 PROGRAM BASED  
ON THE GIVEN RESERVOIR SURFACE AREA AND  
CORRESPONDING ELEVATION INFORMATION. (SEE SUMMARY  
INPUT / OUTPUT SHEETS)

### PMP CALCULATIONS

- APPROXIMATE RAINFALL INDEX = 24 IN (REF 3, FIG 1)  
(CORRESPONDING TO A DURATION OF 24 HRS  
AND AN AREA OF 200 SQ. MI. LOCATED  
IN SOUTHWESTERN PENNSYLVANIA)
- DEPTH - AREA - DURATION ZONE #7 (REF 3, FIG 1)
- LOCAL DRAINAGE AREA  $\approx$  0.33 SQ. MI. HOWEVER, THE STORM  
WILL BE CENTERED OVER THE TOTAL DRAINAGE AREA ABOVE  
BEAVER DAM  $\approx$  54.4 SQ. MI.  $\Rightarrow$

DURATION (HR)	PERCENT OF INDEX RAINFALL (%)
6	85
12	103
24	113
48	124

- HOB BROOK FACTOR (ADJUSTMENT FOR BASIN SHAPE AS WELL AS FOR  
THE LESSER LIKELIHOOD OF A SEVERE STORM CENTERING OVER A  
SMALLER BASIN) CORRESPONDING TO A DA  $\approx$  54.4 SQ. MI.  $\Rightarrow$  0.852

(AS COMPUTED BY HEC-1)

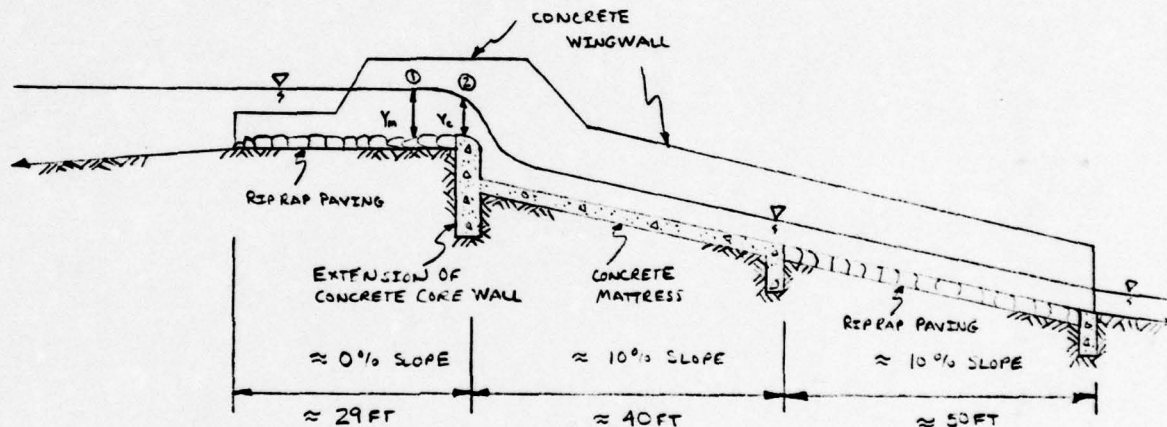
SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-1-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-12-79 SHEET NO. 5 OF 11

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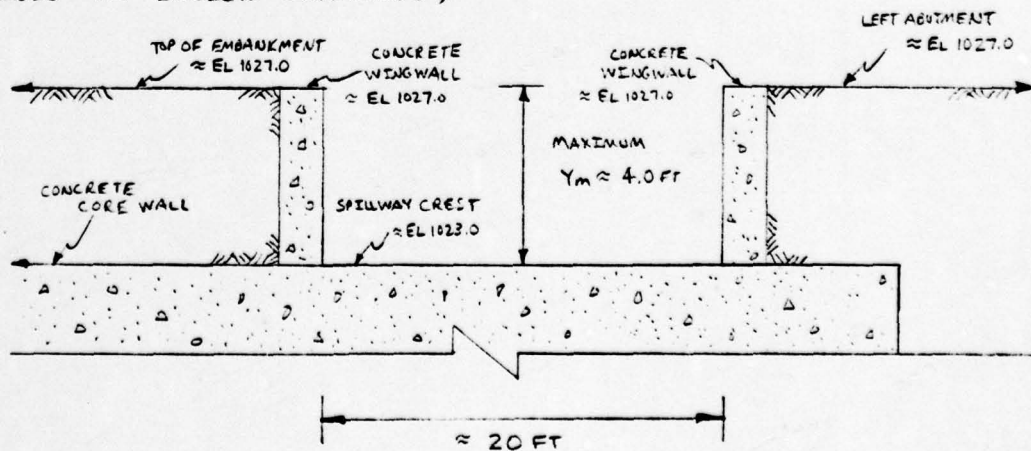
GILKERSON DAM

SPILLWAY CAPACITY

- PROFILE OF SPILLWAY : (NOT TO SCALE)  
 (BASED ON DESIGN DRAWINGS)



- CROSS-SECTION OF SPILLWAY : (NOT TO SCALE)  
 (BASED ON DESIGN DRAWINGS)



SECTION TAKEN LOOKING US TOWARD DAM

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-2-79 PROJ. NO. 79-617-453  
 CHKD. BY DLB DATE 6-12-79 SHEET NO. 6 OF 11



GILKERSON DAM

- THE SPILLWAY IS ACTUALLY IN POOR SHAPE W/ THE CONCRETE IN A DETERIORATED STATE, AND DEBRIS AND VEGETATION OBSTRUCTING FLOW IN THE FOREBAY AREA.
- THE DISCHARGE OVER THE FREE OVERFALL - CHUTE CHANNEL SPILLWAY IS CONTROLLED BY CRITICAL DEPTH AT THE SLOPE TRANSITION POINT, SECTION ② (SEE SKETCH ON SHEET 5). THE MAXIMUM RESERVOIR DEPTH (ABOVE THE SPILLWAY CREST) PRIOR TO OVERTOPPING OF THE DAM ( $Y_m \approx 4.0$  FT) WILL OCCUR @ SECTION ①.
- ENERGY BALANCE BETWEEN ① AND ②:

$$Y_m + \frac{v_a^2}{2g} + Z_1 = Y_c + \frac{v_c^2}{2g} + Z_2 + H_L \quad (\text{REF 7, PG 1})$$

WHERE  $v_a$  = VELOCITY OF APPROACH CHANNEL, IN FPS;  
 $Z_1 = Z_2$  = ELEVATION DATUM = ELEVATION OF SPILLWAY CREST ( $Z_1 - Z_2 = 0$ );  
 $v_c$  = CRITICAL VELOCITY, IN FPS; AND  
 $H_L$  = TOTAL APPROACH LOSS, IN FT.

$$\therefore Y_m + \frac{v_a^2}{2g} = 4.0 + \frac{v_c^2}{2g} = Y_c + \frac{v_c^2}{2g} + H_L$$

$$v_a = Q/A_a = Q/(20 \text{ FT})(Y_m) = Q/(20)(4) = Q/80 \text{ FT}^2$$

$$v_c = Q/A_c = Q/(20 \text{ FT})(Y_c) = Q/20 Y_c$$

$$H_L = \text{CHANNEL FRICTION LOSS} + \text{CHANNEL ENTRANCE LOSS}$$

$$= \underbrace{S_f L + 0.1 \frac{v_a^2}{2g}}_{\text{REF 4, PG 379}} \quad \left( \text{WHERE } S_f = \text{FRICTION SLOPE} \right)$$

$L = \text{APPROACH CHANNEL LENGTH} \approx 29 \text{ FT}$

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-2-79 PROJ. NO. 79-617-453  
 CHKD. BY DLB DATE 6-12-79 SHEET NO. 7 OF 11



GILKERSON DAM

$$S_f \approx \left( \frac{Q^n}{1.49 A_a R_a^{2/3}} \right)^2$$

$$S_f \approx \left[ \frac{Q (0.06)}{1.49 (90 \text{ FT}) \left( \frac{90 \text{ FT}^2}{25.5 \text{ FT}} \right)^{2/3}} \right]^2$$

$$S_f \approx 5.52 \times 10^{-3}$$

WHERE  $n$  = CHANNEL ROUGHNESS  
 FACTOR  $\approx 0.06$ , DUE  
 TO DRY RUBBLE MASONRY  
 W/ VEGETATION (REF 7,  
 PGS 111, 112). AND  
 $R_a = \frac{\text{APPROACH CHANNEL FLOW AREA}}{\text{APPROACH CHANNEL WETTED PERIMETER}}$   
 $\approx \frac{A_a}{[20 \text{ FT} + 2 \left( \frac{Y_c + 1.5}{2} \right)]}$   
 $\approx \frac{A_a}{[20 + 2 \left( \frac{4 + 1.5}{2} \right)]}$   
 $\approx \frac{A_a}{25.5 \text{ FT}}$

- THEREFORE,

$$4 \text{ FT} + \frac{Q^2}{2g} (90 \text{ FT})^2 = Y_c + \frac{Q^2}{2g} (20 Y_c)^2 + [(5.52 \times 10^{-3} Q^2 \times 29) + (0.1 \times \frac{Q^2}{2g} [90 \text{ FT}]^2)]$$

$$4 + (2.43 \times 10^{-6} Q^2) = Y_c + \frac{Q^2}{25760 Y_c^2} + (1.60 \times 10^{-6} Q^2) + (2.43 \times 10^{-7} Q^2)$$

$$4 = Y_c + \frac{Q^2}{25760 Y_c^2} - (5.97 \times 10^{-7} Q^2)$$

ALSO, CRITICAL DEPTH IN A RECTANGULAR SECTION IS  
 DEFINED BY (REF 13, PG 143):

$$Y_c = \sqrt[3]{\frac{q^2}{g}} \quad \text{WHERE } q = \frac{Q}{20 \text{ FT}}$$

$$Y_c = \sqrt[3]{(7.76 \times 10^{-5}) \times Q^2}$$

- BY TRIAL AND ERROR:  $Q \approx 524 \text{ CFS}$ , SAY  $520 \text{ CFS}$   
 $Y_c \approx 2.77 \text{ FT}$

(SINCE THE DS SLOPE  $\approx 10\%$   $\Rightarrow$  CRITICAL FLOW WILL CONTROL)

SUBJECT DAM SAFETY INSPECTION  
BEAVER DAM  
 BY WJV DATE 6-2-79 PROJ. NO. 78-617-453  
 CHKD. BY DLB DATE 6-12-79 SHEET NO. 8 OF 11



Engineers • Geologists • Planner  
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# GILKERSON DAM

## SPILLWAY RATING CURVE

THE SPILLWAY RATING CURVE IS BASED ON THE  
 PROCEDURE OF SHEETS 6 AND 7, AND THE EQUATIONS:

$$Y + \frac{Q^2}{2g(20Y)^2} = Y_c + \frac{Q^2}{25760 Y_c^2} + 29 S_f + 0.1 \left[ \frac{Q^2}{2g(20Y)^2} \right]$$

$$S_f = \left[ \frac{Q(0.06)}{1.49(20Y) \left( \frac{20Y}{20 + 2 \left[ \frac{(Y+1.5)}{2} \right]^{2/3}} \right)^2} \right]^2$$

$$Y_c = \sqrt[3]{(7.76 \times 10^{-5}) \times Q^2}$$

FOR  $1.5 < Y < 4$ , ASSUME  
 FOR  $Y \leq 1.5$ , USE  $Y = 1.5$   
 FOR  $Y > 4$ , USE  $Y = 4$

WHERE  $Y$  = RESERVOIR DEPTH (ABOVE SPILLWAY CREST) @  
 THE ASSUMED ELEVATION

ELEVATION (FT)	$Y$ (FT)	FINAL ASSUMED $Y_c$ (FT)	FINAL ASSUMED $Q$ (CFS)
1023.0	0	0	0
1023.5	0.5	0.22	10
1024.0	1.0	0.53	40
1024.5	1.5	0.88	90
1025.0	2.0	1.24	160
1025.5	2.5	1.61	230
1026.0	3.0	2.00	320
1026.5	3.5	2.38	420
1027.0	4.0	2.77	520
1027.5	4.5	3.17	640
1028.0	5.0	3.58	770
1028.5	5.5	4.00	910

ROUNDED FLOW  
 VALUES

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

BY WJV DATE 6-4-79 PROJ. NO. 78-1217-453

CHKD. BY DLB DATE 6-12-79 SHEET NO. 9 OF 11



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GILKERSON DAM

DAM EMBANKMENT RATING CURVE

ASSUME THAT THE EMBANKMENT ACTS LIKE A BROAD-CRESTED WEIR WHEN OVERTOPPED. THEREFORE, DISCHARGE IS DEFINED BY :

$$Q = CLH^{3/2} \quad (\text{REF 5, PG 5-3})$$

WHERE  $Q$  = DISCHARGE, IN CFS ;

$L$  = LENGTH OF EMBANKMENT  $\approx 280$  FT  
(SEE REFERENCE IN NOTE 1, SHEET 1) ;

$H$  = HEIGHT OF RESERVOIR ABOVE EMBANKMENT  
CREST EL 1027.0 FT, IN FT ; AND

$C$  = DISCHARGE COEFFICIENT  $\approx f(H/2)$ , WHERE  
 $h$  = CREST WIDTH  $\approx 10$  FT)

↳ SEE REFERENCE IN NOTE 1, SHEET 1

ELEVATION (FT)	H (FT)	H/h (FT/FT)	C*	Q (CFS)
1027.0	0	-	-	0
1027.5	0.5	0.05	3.02	300
1028.0	1.0	0.10	3.03	850
1028.5	1.5	0.15	3.04	1560

\* FROM REF 12, PG 46

SUBJECT DAM SAFETY INSPECTION

BEAVER DAM

BY WJV DATE 6-4-79 PROJ. NO. 78-617-453

CHKD. BY DLB DATE 6-12-79 SHEET NO. 10 OF 11



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GILKERSON DAM

TOTAL FACILITY RATING CURVE

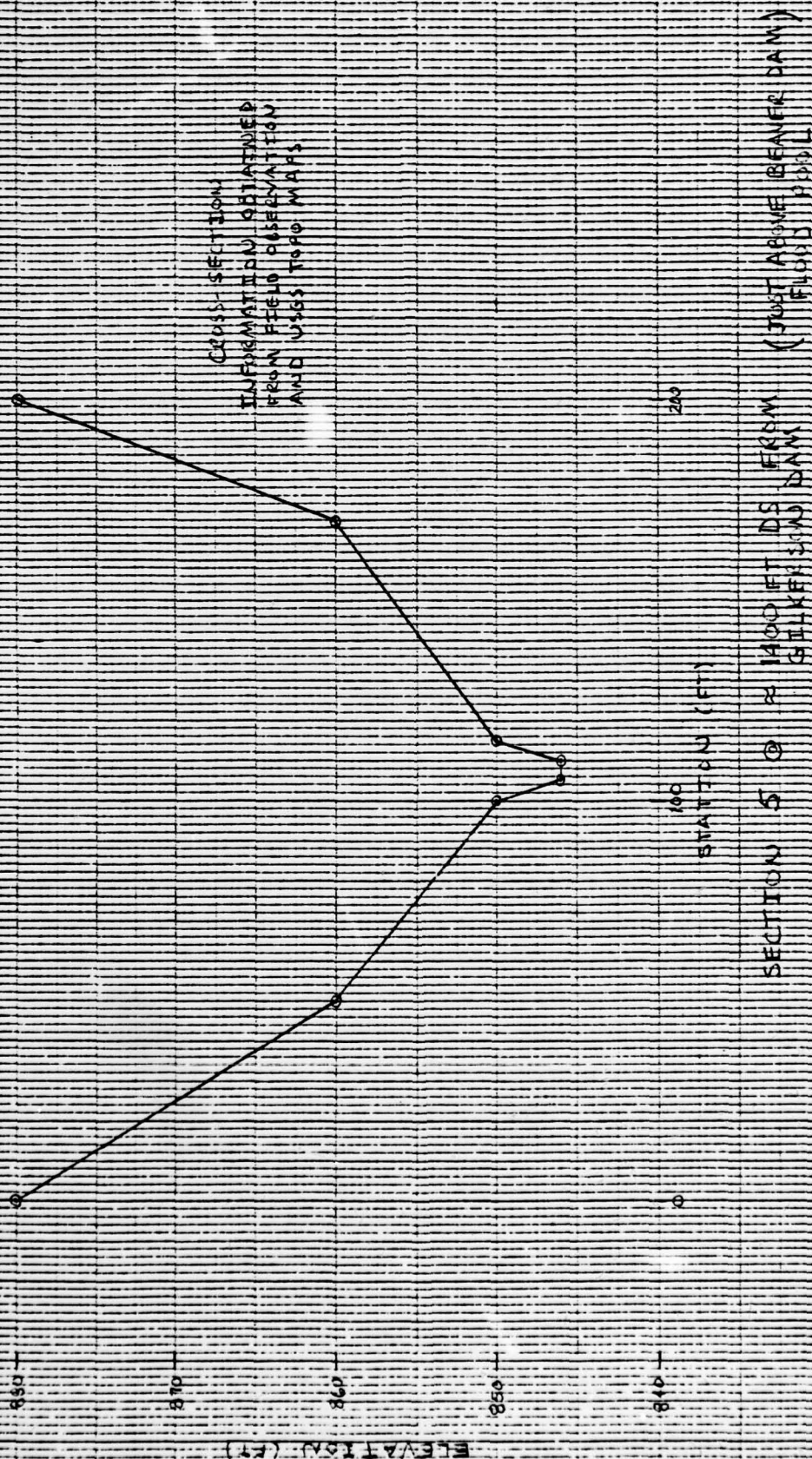
ELEVATION (FT)	* SPILLWAY Q (CFS)	** EMBANKMENT Q (CFS)	TOTAL Q (CFS)
1023.0	0	-	0
1023.5	10	-	10
1024.0	40	-	40
1024.5	90	-	90
1025.0	160	-	160
1025.5	230	-	230
1026.0	320	-	320
1026.5	420	-	420
1027.0	520	0	520
1027.5	640	300	940
1028.0	770	850	1620
1028.5	910	1560	2470

\* FROM SHEET 8

\*\* FROM SHEET 9

# DOWNSTREAM ROUTING SECTION

SHEET 11 OF 11



APPENDIX D  
PHOTOGRAPHS

PHOTOGRAPH 1

Overview of Beaver Dam as seen from the hillside at the right abutment.

PHOTOGRAPH 2

Downstream view of the spillway.

PHOTOGRAPH 3

Close-up view of the left wingwall of the spillway.

PHOTOGRAPH 4

View of a temporary construction road cut through the left embankment near the left abutment.



2



4



1



3

PHOTOGRAPH 5

View of the blowoff valve control mechanism as seen from atop the circular masonry vault at the right abutment.

PHOTOGRAPH 6

The outlet conduit inlet structure located adjacent the right hillside about 100 feet upstream of the embankment.

PHOTOGRAPH 7

View of discharge emanating from the outlet conduit (not visible in view) via a rock tunnel cut through the right abutment. The discharge is also visible in the extreme left center of Photograph 2.

PHOTOGRAPH 8

View of the area immediately downstream of the dam.



6



8



5



7

PHOTOGRAPH 9

View, looking upstream, toward the silted reservoir.

PHOTOGRAPH 10

View showing sedimented reservoir condition.

PHOTOGRAPH 11

View of the first downstream residences located along the floodplain approximately 1500 feet downstream of the embankment.

PHOTOGRAPH 12

View, looking upstream, from bridge located a distance of about 2000 feet from the dam.



9



10



11



12

APPENDIX E

GEOLOGY

## Geology<sup>1</sup>

Beaver Dam is located in the Pittsburgh Plateaus Section of the Appalachian Plateaus Physiographic Province of western Pennsylvania. This section is characterized as a high plateau underlain by flat-lying to gently folded sedimentary rock strata. In the vicinity of the dam and reservoir, the Pennsylvanian age rocks gently dip to the northwest at approximately 125 feet per mile or less than two degrees.

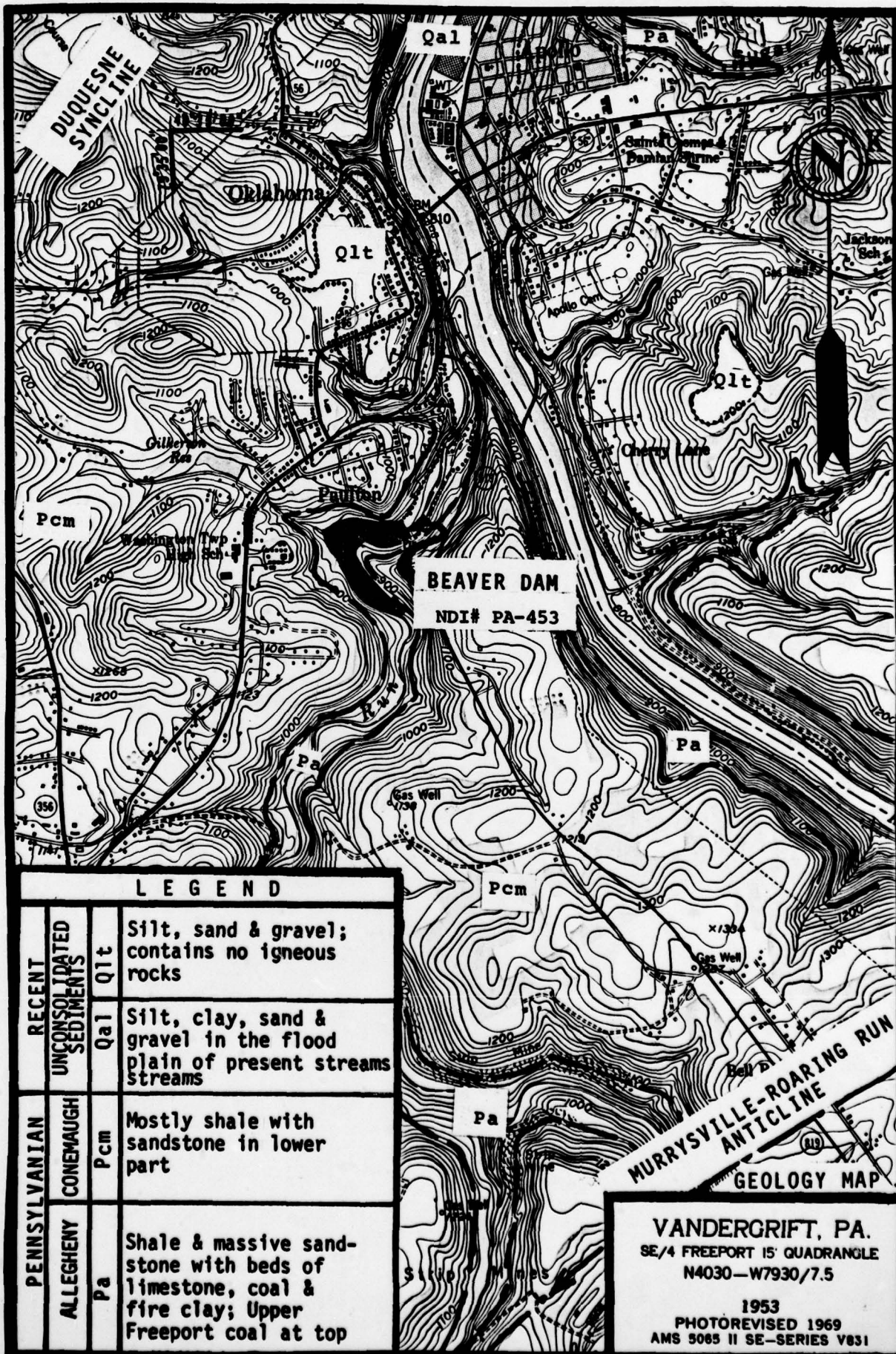
Structurally, the dam and reservoir are located between the Murrysville-Roaring Run Anticline to the southeast and the Duquesne Syncline to the northwest. The axes of these structures conform to N30°E trend typically displayed by the folded structures of the Pittsburgh Plateaus Section.

The sedimentary rock strata contained in the abutments and underlying the alluvial deposits flooring the Beaver Run valley are members of the Allegheny Group of Pennsylvanian age. The strata of this group extends from the top of the Upper Freeport Coal to the base of the Brookville Coal and have an average thickness of about 300 feet in the vicinity of the site. The Allegheny Group contains several coalbeds as well as clay and limestone. The intervening measures are sandstones and shales being quite similar to the strata characteristics of the overlying Conemaugh Group. The Upper Freeport Coal horizon which marks the upper limit of the Allegheny Group occurs in both abutments above the dam. The Upper Freeport Coal in the right abutment is completely

mined out whereas coal in the left abutment in apparently in-place, although it may be locally mined along the outcrop.

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<sup>1</sup>Hughs, Herbert H., "Geology and Mineral Resources of the Freeport 15 Minute Quadrangle, Pennsylvania," Topographic and Geologic Survey, Atlas 36, 1933.



APPENDIX F

FIGURES

LIST OF FIGURES

<u>Figure</u>	<u>Description/Title</u>
1	General Plan - Field Inspection Notes

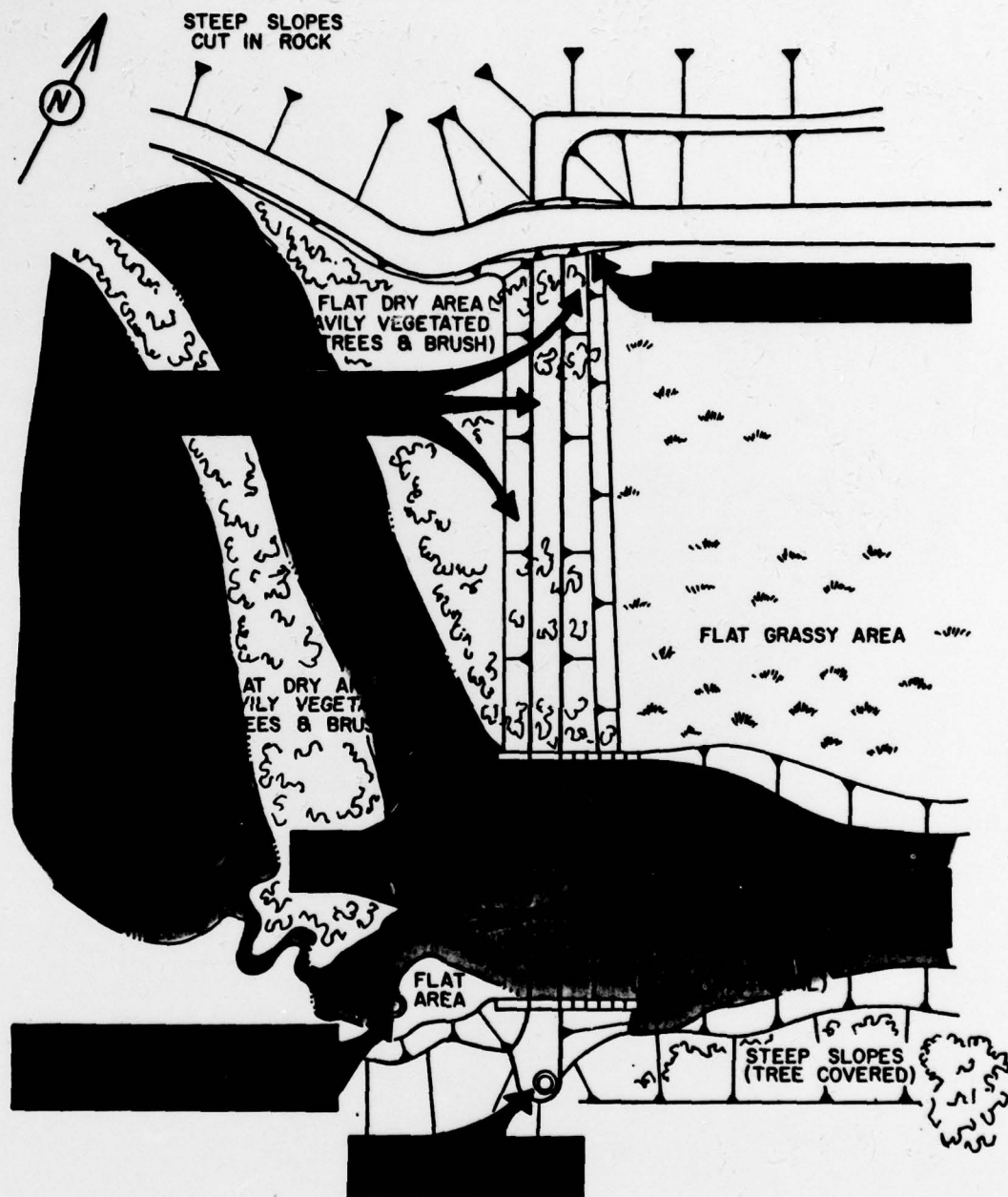
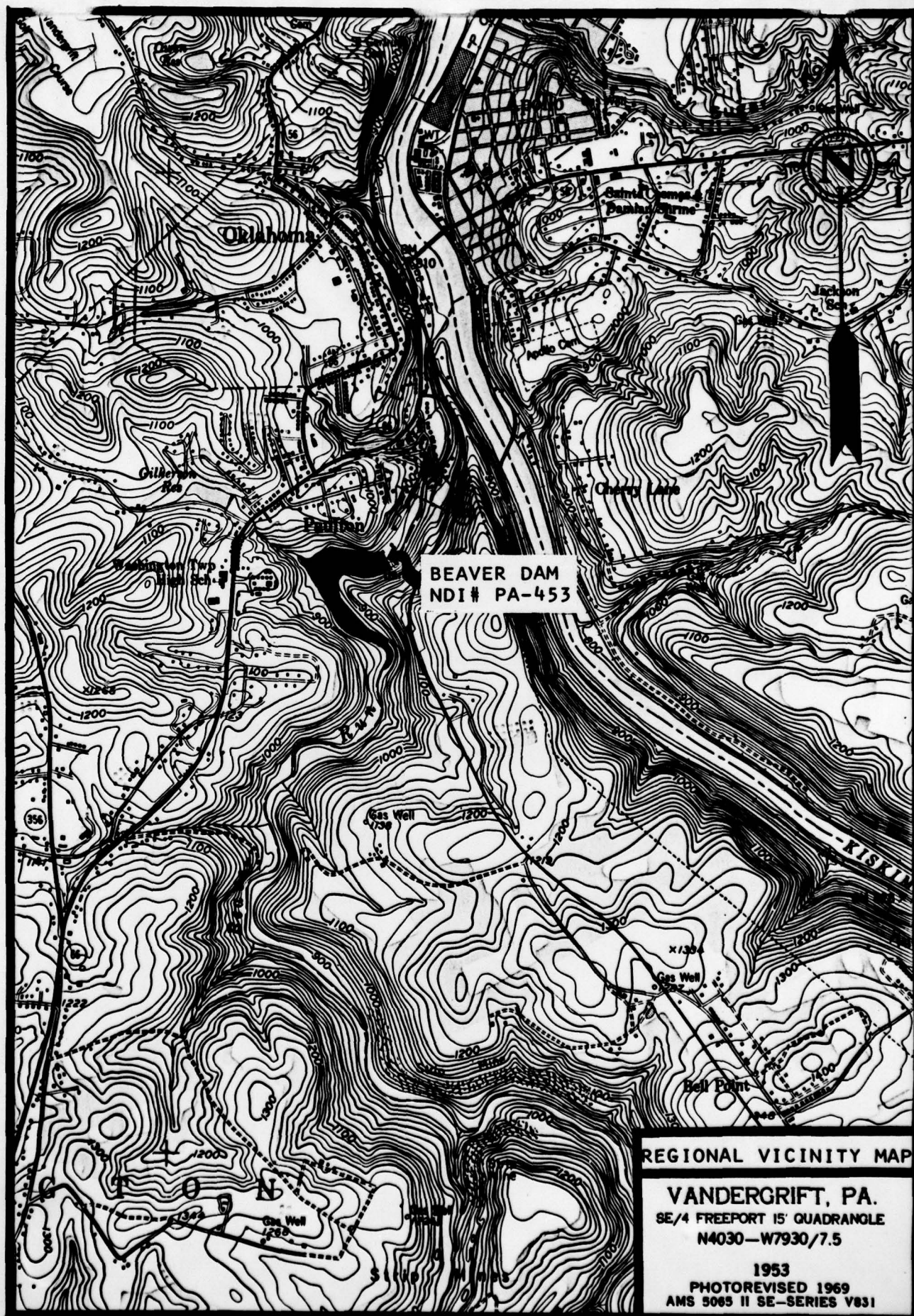


FIGURE 1 - BEAVER DAM  
GENERAL PLAN  
FIELD INSPECTION NOTES

APPENDIX G  
REGIONAL VICINITY  
AND  
WATERSHED BOUNDARY MAPS



REGIONAL VICINITY MAP

VANDERGRIFT, PA.

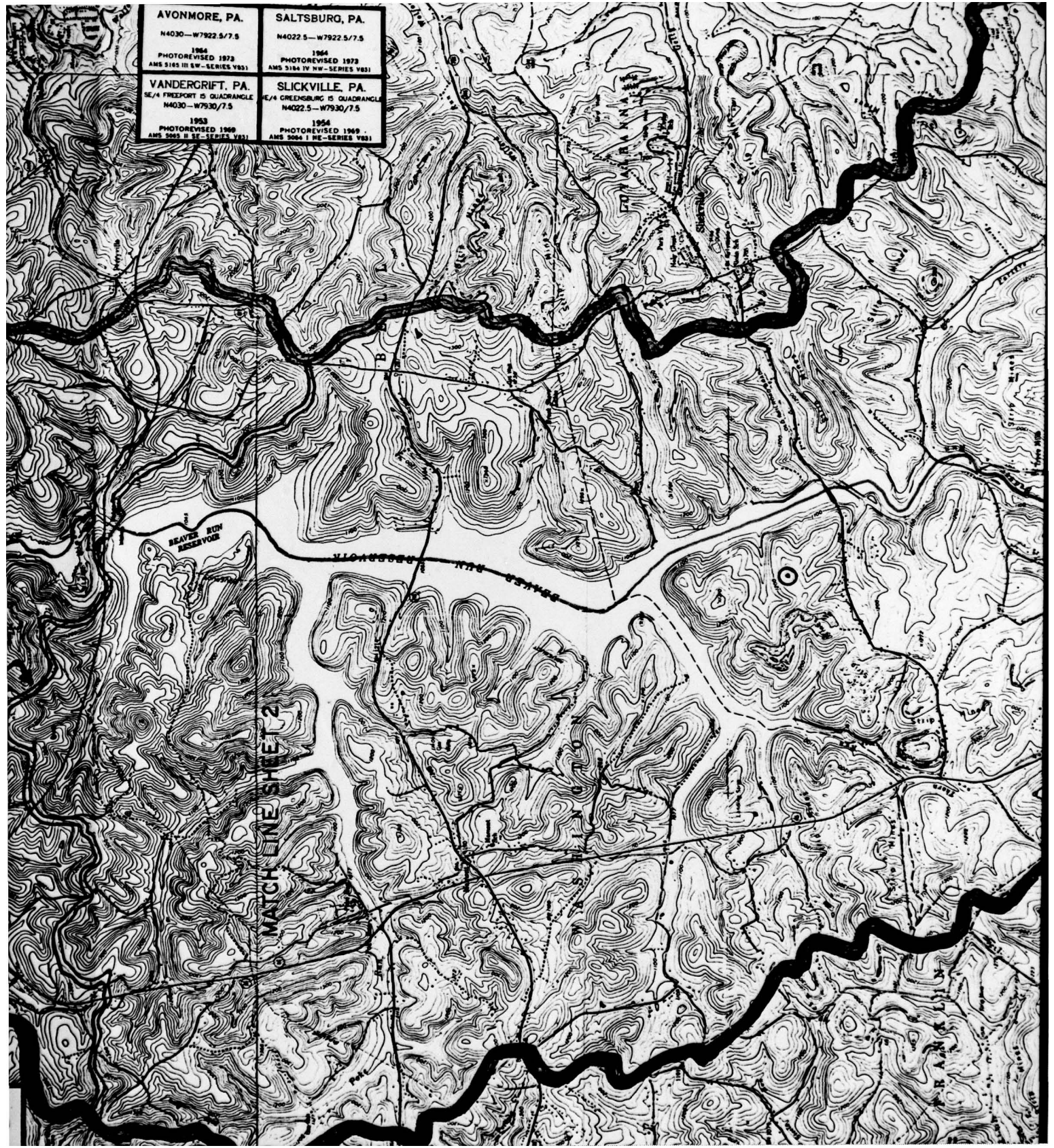
SE/4 FREEPORT 15' QUADRANGLE  
N4030—W7930/7.5

1953

PHOTOREVISED 1969  
AMS 5065 II SE—SERIES V831



<b>AVONMORE, PA.</b> N4030—W7922.5/7.5 1964 PHOTOREVISED 1973 AMS 5165 III SW—SERIES V831	<b>SALTSBURG, PA.</b> N4022.5—W7922.5/7.5 1964 PHOTOREVISED 1973 AMS 5164 IV NW—SERIES V831
<b>VANDERGRIFF, PA.</b> SE/4 FREEPORT S QUADRANGLE N4030—W7930/7.5 1953 PHOTOREVISED 1969 AMS 5065 II SE—SERIES V831	<b>SLICKVILLE, PA.</b> NE/4 GREENSBURG S QUADRANGLE N4022.5—W7930/7.5 1954 PHOTOREVISED 1969 AMS 5064 I NE—SERIES V831



<b>AVONMORE, PA.</b> N4030—W7922.5/7.5 1964 PHOTOREVISED 1973 AMS 5145 III SW—SERIES V831	<b>SALTSBURG, PA.</b> N4022.5—W7922.5/7.5 1964 PHOTOREVISED 1973 AMS 5144 IV NW—SERIES V831
<b>VANDERGIFT, PA.</b> SE/4 FREEPORT IS QUADRANGLE N4030—W7930/7.5 1953 PHOTOREVISED 1969 AMS 5065 II SE—SERIES V831	<b>SLICKVILLE, PA.</b> E/4 GREENSBURG IS QUADRANGLE N4022.5—W7930/7.5 1954 PHOTOREVISED 1969 AMS 5064 I NE—SERIES V831

